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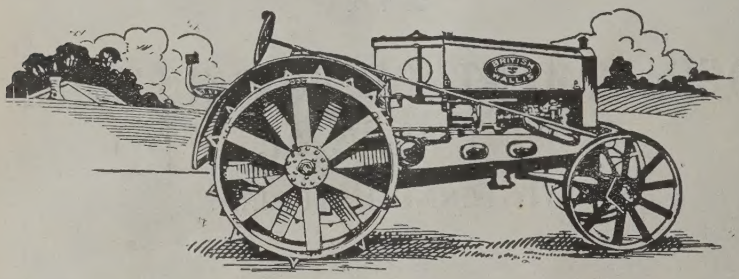

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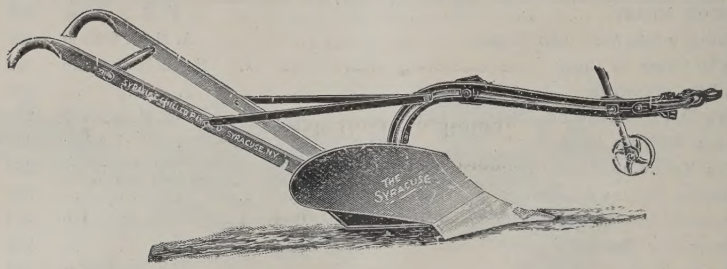

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FODDER CROPS AND DAIRYING.

It is unfortunate, but none the less true, that agricultural development in the South-West portion of Western Australia has not proceeded at an equal rate with other areas along that avenue of dairy farming which the term "Agriculture" includes, and for which it is particularly adapted. In the matter of wheat production, for instance, the advances made by this State of recent years have been phenomenal, but so far as dairy production is concerned the advance made has been of the most modest, and in no way is the progress representative of the possibilities. An examination of the figures relating to wheat production and dairy production, as shown in the returns of the Registrar General, makes it very evident that while very great enterprise and initiative have been thrown into the former, the latter has simply been drifting along in a manner that suggests a serious lack of appreciation of a potential source of wealth. If there were any good and sufficient reasons for this, the position would not be difficult to understand, but as a matter of fact there is no good and sufficient reason. It cannot be advanced, for instance, that the South-West is not well adapted for the production and nutrition of prime dairy cattle, nor can it be contended that there is not sufficient market for the products of dairy farming, nor that the primest butter cannot be manufactured there. In all cases the facts point in an entirely opposite direction. With the exception of a few detached patches almost the whole of the South-West of this State holds those conditions which are essential to successful dairy farming, and the market is assuredly with us, for a study of the import figures of the State makes it abundantly clear that in order to meet the demands of the local market very large sums of money are sent to the Eastern States in payment of imported dairy produce. This is a condition of affairs which in the

interests of the State and its people should not be allowed to continue. If all the material conditions and elements are present for the successful conduct of dairy farming here, to what may the present backward position be attributed? Several reasons may be put forward, but beyond a doubt the one which is most intimately associated with the matter is that of favourable environment. There is such a thing as a dairy atmosphere, and until such an atmosphere is in existence in any district, dairying will be carried on without enthusiasm and without that fire and force which spells success. It is essential that we should give more serious attention to the cultivation of fodder crops adapted to the South-West and suitable for dairy cattle than has been the case in the past. In this State, as elsewhere, there are periods when succulent feed, that is, succulent feed of the right sort, is scarce; it is essential, therefore, to success in dairy farming that measures should be taken for bridging over these periods of scarcity, short as they may be and shorter than in many dairy countries. The dairy cow is an animal whose physical well-being demands suitable succulent food throughout the whole milking period, and if that demand is not met, then her produce will fall short of what it might have been. It is necessary in the interests of the dairying industry of the State that we, having established a high quality of butter, should maintain that high standard unbroken. This can be done in the South-West of this State throughout the summer months only by careful provision for keeping them well supplied with succulent food during the dry spell. The dry natural pastures in summer do not afford the succulence that the cow demands. Their deficiency must, therefore, be made good by the cultivation of succulent fodder crops of the proper kind. In this matter dairy herd owners of Western Australia have an advantage over their brethren in Europe, Canada, and North America. The period of scarcity here occurs during the warm weather, while in the countries named the time of scarcity occurs when the weather is cold, and much of the vital force of the animal goes into developing heat instead of producing milk. In other words, the period of scarcity in Europe, Canada, and North America is accompanied by conditions which the dairy farmer is unable—except to a slight extent by housing the herd—to modify or to combat. During their cold spell fresh crops of any kind are unobtainable, so that the cattle must be fed from silage or from roots stored in pits. But in Western Australia the position is altogether different. The dairy farmer has it in his own power to arrange matters in such a way that his dairy cattle need suffer little or none at all during the season of scarcity. By looking ahead a little and making the required provision, the local dairyman can provide in plenty that kind of food which the milking cow demands. In the South-West of this State the dairy farmer can provide succulent and nutritive food by several kinds of crops actually growing and ready for use at the time when the natural pastures are dry and unnutritious. Of these crops, maize, Sudan grass, and sorghum must be mentioned as the most suitable for the purpose and as those which may be most freely relied upon to produce the best results. It is evident, therefore, that there

are in existence in the South-West all the conditions that are necessary for successful dairying farming. We are to-day in fact in the position which was occupied by quite a number of districts in the Eastern States in times that are past, and which are now the centres in which dairy production has risen to a high level, and, indeed, forms the main industry in these centres. The existence of the required conditions and the proper environment evolved a dairy consciousness and created a dairy atmosphere, and these translated into practice have made the centres in question great and steady producers of wealth. Not only are the Eastern States able to supply themselves with butter, but they are also large exporters, and the butter from them is competing successfully in British and other European markets with butters from other countries which, prior to the advent of the Australian article, had an almost exclusive occupation of these markets. Western Australia's backwardness, viewed in the light of what has been done in the East, stands out with unpleasant distinctness. This State to-day does not produce nearly enough butter for its own requirements, and to make up the deficiency the citizens of Western Australia pay to the Eastern States for butter a sum annually which approaches £500,000. The figure for the year ending 1922-23 was £525,000. This condition of affairs is deplorable, and the regret becomes all the deeper when it is borne in mind that Western Australia does not pay for butter from outside because it cannot produce the article itself. Critics in the Eastern States in their estimates of Western Australian energy and enterprise very often declare that the citizens of this State are lacking in energy and initiative, and they also go on to point out the avenues in which profitable industry might be engaged in, but which, for some reason hard to understand, have not, so far, been occupied. Butter production is emphatically one of the avenues in which Western Australia lags behind. It has already been pointed out that there are here all the conditions and constituents which are essential to the establishment and maintenance of a highly profitable butter industry, and it is now urged that those whose environment in the South-West is favourable should seriously turn their attention in a direction which holds out attractive promise with good results. If Western Australia produce the article there can be no question about the markets that will absorb it. First of all, there is the local market to fill, and the filling of that alone would mean that Western Australian dairymen would keep within the State the very large sum that is yearly sent out of it for butter. Then again, the European market is ready to absorb all the butter that Australia can produce, and of recent dates inquiries for Australian butter have been coming forward from New York. The butter producing industry in this State at the present moment is so partially developed that it amounts to something of a reproach, since it implies that we have not been making the best of our opportunities.

A WORD TO NEW SETTLERS.

Western Australia is anxiously looking for population. It is inviting settlers not only from Great Britain, but from others of the white civilised nations, and it has called into being all the machinery that is necessary for the comfortable settlement upon the land of these new comers. It is not expected that all the settlers will have knowledge of agricultural pursuits. Indeed, it is anticipated that the majority of them will have virgin minds on all matters agricultural. That being the case, it is essential that new comers desiring to go upon the land, but with no special knowledge regarding agricultural matters, should have at hand some agency or combination of agencies to which they may apply and upon whose advice they may with confidence rely. The Department of Agriculture has been organised for the special purpose of undertaking such duties. New settlers and those engaged in the comfortable settlement on the land of new arrivals should steadily bear in mind that all the energies of the Department are directed toward one end, viz., that of rendering efficient service to the men on the land. It is the aim of the Department to be not only the adviser of the new comer, but to be the friend and guide of all those whose knowledge of agricultural operations is limited. The environment in which a new comer from Great Britain to Western Australia finds himself is so vastly different from that to which he has been accustomed that success or failure to a very large degree depends upon the quality of the information and assistance which is afforded him. It is particularly the desire of the Department that new comers should clearly understand that in asking the help of the Department of Agriculture in any particular they are not asking a favour, but are really requesting that to which they have every right. Residents of long standing in Western Australia, in opening up new country for agricultural production, are often faced with problems that are strange and puzzling to them. If that be so with persons who have had experience of farming before, how much greater and more perplexing must be the problems which confront a new arrival whose knowledge of agricultural pursuits is meagre or non-existent? The present organisation of the Department is the result of long years of careful study and investigation by officers in charge of it, and to-day it may be fairly claimed that its list of activities covers the whole range of agricultural endeavour.

The device on the Department's shield is "Helping Hand," and the legend underneath is "I serve," and in its work no effort is left undone to translate the old, proud motto into fruitful accomplishment.

New settlers desiring advice of the Department in any subject connected with the working of their holdings should address their communications, in the first instance, to the Director of Agriculture, Perth.

MAIZE—THE KING OF FODDER CROPS.

Geo. L. Sutton,
Director of Agriculture.

The maize plant has been described by Henry as "The Imperial Agricultural Plant of America," and in that country it is certainly the "King of Fodder Plants."

Under suitable conditions and when sown thinly a heavy crop of grain is produced, and when sown thickly little grain is produced but a heavy yield of succulent fodder is obtained, and this can be made into bright and nutritious but coarse hay or the best of silage.

Prosperous dairying in this State is largely bound up with the successful cultivation of the maize plant for fodder purposes, and at the present time it is specially valuable, for this hardy prolific plant furnishes the means by which the group settlers can increase the carrying capacity of their farms whilst their pastures are being laid down and established.

The whole of the plant is useful for stock food—no part except the roots need be wasted. It can be used at any stage of its growth, but supplies the maximum amount of food material when almost mature; at this stage it furnishes a very large quantity of greenstuff suitable for the bulky part of the ration for dairy cattle or idle animals.

The maize grain when ripe furnishes a concentrated stock food, hard, rich in starch and oil for producing heat and energy, and therefore admirably suited for hard-working animals, especially in winter. The grain is comparatively low in protein and ash, and is therefore not suitable for feeding alone to young animals and milking cows; if it is to be used for this purpose it requires to be mixed or balanced with foods rich in protein like linseed meal, bran, clover or lucerne.

Even the stalks from which the grain has been removed have a feeding value of about one-third the total food value of the whole crop at the time of removal. The stalks from which the cobs have been removed are known as "Stover" in distinction to "Fodder" maize, which applies to the stalks either green or dry, and from which the grain, if they carry any, has not been removed.

The maize plant is botanically known as Zea mays—hence the common name "maize" by which it is known in this State. It is a native of the warmer parts of Central America, and in that country is usually referred to as "Corn," just as wheat, the staple grain of Britain, is also known as "Corn." To distinguish it from wheat, where there is likely to be some comparison between the two grains, it is called "Indian Corn," the term "Indian" being used because the early American settlers and explorers found the American Indians cultivating this plant.

The maize plant grows to a height of from two to 18 feet, according to variety and conditions of soil and climate under which it is grown. The stem or stalk has joints or nodes like the straw of wheat and oats, and this when mature has a pithy interior, which is covered with a thin layer of hard glossy material. Broad succulent leaves are found growing along the stem, a single one growing from each joint. The stalk as it reaches maturity ends

in what is known as the "tassel," and this is the male portion of the flower. The other portion of the flower is known as the "silk," and consists of a mass of fine silk-like hairs enclosed in a covering known as the "husk," and in

A Fodder Maize Crop, Busselton, W.A.

what the grains produced are formed. The "silk" being located below the "tassel," the pollen of the latter is blown about in the air so as to provide the opportunity for it to fall on the "silks," and if the conditions are favourable these are fertilised. Each silk extends for a into the husk and to what will

eventually become a grain of "maize" if fully fertilised. The grains when developed are arranged around a cylindrical central portion known as the "core" or "cob," and this with the grains attached is known as an "ear" of maize. A badly fertilised "ear," which has only a few grains on it, is known as a "nubbin."

Varieties.—The number of varieties of maize is almost legion. So little maize has been grown in this State that there have not been many opportunities for testing the merits of different types. This problem is not at all acute, for it is known that some varieties, *e.g.*, "Hickory King," will yield excellent crops of fodder throughout the dairy belt, and though it is possible that some other variety may outyield this by two or three per cent., no farmer will suffer seriously if he confines his attention to this variety for fodder and to "Wellingrove" for grain, or to the few others which are available from local seedsmen. It is far more important to increase the area under maize ten or twenty fold almost immediately than to discuss or consider the possible advantages of some of the other 500 odd varieties, white and yellow, which may be available elsewhere.

Climate and Soil.—The maize plant, being indigenous to the warmer parts of South America, thrives best under warm moist conditions, and, as might be expected, it is killed by frosts. It will resist drought, however, if the ground is in good condition and well cultivated between the plants until the tasselling period. The experience already gained in this State conclusively demonstrates that it can be grown in the Dairy Belt. One of the very finest crops of fodder ever seen by the writer was that grown by Mr. W. R. Reilly in 1922, about six miles from Busselton and near the centre of one of the localities now devoted to Group Settlement in that district. The character of this crop can be seen from the illustration on the previous page.

The most suitable soil for maize is a deep sandy loam well charged with organic matter, such as is found in alluvial flats along river banks, and at one time it was considered that maize could only be grown profitably on such soils. It has been found, however, that new and improved varieties, *e.g.*, Hickory King, already referred to, will grow on a variety of soils, and on those which at one time were regarded as quite unsuitable, provided the land is thoroughly prepared, suitably manured, and the soil between the plants properly cultivated during the growing period.

For the production of grain the critical period is the tasselling stage, and favourable weather and abundant moisture at this time are essential for heavy grain crops. In districts with a limited summer rainfall these conditions are ensured by means of irrigation or by the selection of land known as "summer" or "moist" land, and which has subsoil moisture within about one to two feet of the surface. An irrigated crop is shown in the illustration herewith. It was grown by Mr. E. Forrest, Picton House, near Bunbury.

Preparation of Seed Bed.—Maize is deep rooting; the soil should therefore be deeply prepared; on average soils the depth ploughed should not be less than five inches and may reach eight inches. It should be *thoroughly* done, for no amount of cultivation after the crop is up can compensate for the lack of thorough preparation. If possible the ploughing should be done some time before the planting so as to give the soil opportunities to mellow. This is particularly so in the case of heavy clay lands, which will benefit considerably by being exposed to the action of frost during the winter. After

ploughing the ground should be brought to a fine tilth by the use of harrows, including the disc harrow, if necessary, to deal with and pulverise pasture land. If the ground is at all cloddy the lumps will require to be broken with a roller or clod crusher. This latter can be made by bolting three or four two-inch planks about five feet long weatherboard fashion on to bearers. On loose sandy land the roller will be useful for compacting the seed bed.

Irrigated Maize, Picton, W.A.

Date of Planting.—The time for planting will depend upon the climate of the district in which the crop is to be grown, as maize will not stand frost. It should therefore be planted late enough to escape late frosts in spring and early enough to miss the early frosts in autumn. In the main part of the dairy belt the month of October will be found safe for early planting, and at the Denmark Stud Farm it has been found practical to plant as late as January for maize for silage—the usual planting date for the silage crop being the first week in January. Between these two dates there is a wide range for planting at intervals to secure a succession of green stuff for dairy purposes. It is anticipated, however, that November will be found the most suitable month for the main planting throughout the Dairy Belt.

Rate of Seeding.—The practice of sowing maize broadcast is almost universal in Western Australia. Such a method is, however, no longer in accordance with modern practice in the Eastern States and the United States of America, and it is desirable that it should be discontinued here, even when intended for fodder purposes only.

Maize intended for grain is planted in either drills or "hills"; under the former method the single plants are grown at regular intervals in rows, under the latter a cluster of plants (two or more) are planted at regular intervals in rows in holes or "hills." It has been found inadvisable to have more than

four plants in a "hill," and the common practice is to have three. Experiments have shown that there is little or no difference in the yield whether maize is planted in "hills" or drills.

The "hills" are said to be checked when the hills are in lines at right angles in the direction of planting, just as in many orchards the trees are in lines in two directions, one at right angles to the other. The checked hill method has the advantage of allowing the land to be cultivated two ways, and thus facilitates the destruction of weeds in dirty paddocks. To enable the proposed crops to be planted according to this system, special appliances called "check row" attachments have been devised for use with double-row planters. When a machine-planter with such an attachment is not available, a common plan is to strike out furrows across the length of the paddock the distance the rows are intended to be, and then plough out other furrows running across the width of the paddock, and sow the seed (say four grains) where the furrows intersect one another.

Great variation has obtained in America and Eastern Australia with regard to the number of plants to the acre, and has ranged almost all the way from 5,000 to 50,000 per acre. The drills have varied from three to five feet apart, with single grains one and a-quarter to four feet apart in them. The closer distances usually give the greatest yield of food material, but with smaller cobs and more "nubbins." When the crop is grown for grain the husking of the smaller ears increases the cost of harvesting, and so the happy mean between high yield and low cost of husking is sought.

There will always be some variation in the number of plants per acre necessary for best results, on account of the difference in varieties and climate. As the result of many experiments the tendency now, however, is to maintain a uniform distance between the drills about 40 inches, and to vary the distance between the plants in the drills. It is believed that under Western Australian conditions maize planted in drills about three and a-half feet apart with single plants 12 to 15 inches apart will give best results for grain, and with plants four to six inches apart best results for fodder or silage. At these distances the amount of seed required per acre will be:—for fodder or silage, 14 to 18 lbs.; for grain, six to eight lbs. If planted in "hills" it is recommended that the "hills" be three and a-half feet apart each way, with three grains to the hill.

At one time it was thought that grain from the middle of the cob was better for seed purposes than that from the pointed end or "tip," or from the "butt," *i.e.*, the end to which the husk if attached. Numerous experiments, however, have shown that, as far as the resulting yield is concerned, it is immaterial from which part of the cob the seed is taken. That from the middle, however, has the advantage that it is more regular in shape and size, and, therefore, more suitable for machine planting.

Treatment of Seed.—Sometimes birds, *e.g.*, crows, are troublesome and follow the drill marks and pull up the seed after it is planted. To prevent this the seed is coated with coal tar by pouring coal tar over the grain at the rate of one pint to the bushel, and then stirring it with a stick until the grains are evenly covered. When covered they are dried for planting by mixing with sand or ashes.

Depth of Plant.—Maize being a large seed, quite a considerable percentage will grow if planted four and five inches deep, but from two to three inches deep is considered the best depth to sow. It throws out brace or

secondary roots as well as primary ones, the object being to resist the effect of heavy winds on such a tall plant. It is considered desirable to have these roots well below the surface, and it may be thought this can be accomplished by planting deeply. This, however, is not so, for no matter how deep the planting, the secondary or brace roots will grow just below the surface, whether planted as deep as six inches or as shallow as two inches. To overcome this characteristic the practice of planting the seed two inches deep at the bottom of an open plough furrow, and then to fill in the furrow by successive cultivations as the plant grows, is sometimes adopted. This method is known as "listing." It is claimed by its advocates that a "listed" crop will stand drought better than one planted on the level. Sometimes such a method is necessary during a dry spell in order to reach the moisture necessary for germination. This was the case at the Denmark Farm last season, and resulted in practically the only crop fit to harvest in the district owing to an abnormally dry summer.

Maize Planting Machine.—Single and double row maize machines for planting are now available. They are expeditious and do extremely satisfactory work. They are designed to sow the seed in "hills" or single grains at regular intervals, and with suitable plates can be used to sow seeds as

Single row Maize Planter.

small as turnip seed or as large as French beans. They are also fitted with an attachment for applying the fertiliser, and with a device for marking out the line for the driver to follow when planting the next row or rows. These machines open the furrow, drop the seed, cover and press the seed into the soil in one operation. This last operation of pressing the seed into the soil is of considerable importance, and is done by the rear or driving wheel, which has a concave surface. The best machines have what may be described as a "split" covering wheel, that is, it is in two pieces with a space of about

three-quarters of an inch between each side. If the surface of the covering wheel is unbroken all the soil above the seed is compacted or firmed, whereas if there is a space between the two edges the soil immediately above the grain is loose, and does not become badly crusted if rain falls before the seed shows above the ground.

Because of the importance of pressing the seed into the moist soil, to assist germination, hand planted seed should be pressed with the foot as it is dropped.

Single row planters can be drawn easily by one horse, but when the machine is used with the marker on, it runs more smoothly and is less strain on the driver if a pair of light horses are used. About seven acres is a fair day's planting with a single maize planter with drills three and a-half feet apart.

Manuring.—Unless it is intended to replace all the plant food removed by the crop, the system of manuring will be governed to some extent by the character of the soil on which it is grown, for under other conditions the farmer will desire to utilise some of the latent fertility of the soil. As a guide to what may be expected in this connection it may be stated that sandy soils are deficient in practically all the elements of plant food and peaty or swamp soils deficient in the mineral constituents (phosphoric acid and potash), whilst clay soils are usually well supplied with potash.

Because of the large tonnage produced, a crop of fodder maize removes from the soil a very considerable amount of plant food. A 10-ton crop, which is only a fair one, will remove about 80lbs. of nitrogen, 30lbs. of phosphoric acid, and 70lbs. of potash. Of these constituents nitrogen is much the most expensive, relative rates per pound being: nitrogen 11, phosphoric acid 2.7, potash 2.8 pence. To supply the whole of the quantity of nitrogen required by means of commercial fertilisers is economically impossible. Fortunately it can be supplied indirectly and without cost by sound farming methods, as the result of growing a legume to precede the maize crop, for legumes have the ability to collect and store up this valuable plant food from the free nitrogen present in the air. Subterranean clover is a legume, and grows most luxuriantly throughout the Dairy Belt. It should therefore become an established practice to arrange that the maize crop follows subterranean pasture after second or third year, though this it not so necessary in peaty soils. When maize is to succeed clover the land should be ploughed up sufficiently early in the winter to enable the clover roots and stubble to become partially decomposed and incorporated with the soil before the maize is planted.

Farmyard manure or any coarse manure can be applied with very great advantage and in any quantity with perfect safety to this crop. There is no danger of heavy dressings injuriously affecting maize, as would be the case if applied to the wheat crop in the Wheat Belt. Nor is there any need to wait until it rots before spreading it on the land intended for maize, for the cultivation which must be given the maize crop will destroy the weeds which may grow from the unrotted manure. It can be spread with advantage on the subterranean clover sod as fast as it is made and ploughed in at convenient times. The maize plant, because it is a gross feeder, can make use of the coarse unrotted manure, and it is assisted in this direction by the fact that it makes most of its growth during the summer when nitrification and

other natural agencies are most active, and in consequence a larger proportion of the plant food constitutents are made available than would be the case if the crop were grown in the winter.

Because of their usual deficiency in phosphoric acid, it is probable that on all our soils it will be advisable to supplement the application of stable manure, and the plant food accruing from the turning in of the clover sod with an application of superphosphate, and on sandy and peaty swamp soils with some potash.

Pending the securing of definite local information regarding the crop requirements under our conditions of soil and climate, it is recommended that the fertiliser used on sandy and peaty soils consist of a mixture of superphosphate five parts, sulphate or muriate of potash one part applied at the rate of two and a-half to five cwt. per acre according to the natural fertility of the soil, and on alluvial or clay loams an application of from one and a-half to three cwt. of superphosphate per acre. If the maize be planted on land which has not had subterranean clover or other legume preceding it, it will be advisable to add at least a half cwt. of sulphate of ammonia per acre to the above fertilisers. With this latter addition the fertiliser will be of similar composition to the special orchard manure put up by the fertiliser firms.

Single row Maize Cultivator.

The fertiliser can be applied at the time of planting, but as it is risky to have potash fertilisers in direct contact with the young rootlets, provision should be made to prevent this either by stirring the fertiliser into the soil before the seed is planted or by some other method.

Cultivation after Planting.—Much if not the whole of the success which will attend the cultivation over a large part of the Dairy Belt will depend upon the cultivation given to the soil after the crop is planted. A huge crop

—up to 20 tons—which the maize plant is capable of producing in a short time, requires a considerable quantity of moisture and plant food. By cultivating the soil between the rows of plants, the weeds which would rob the maize of both moisture and food are destroyed, the moisture is conserved by reducing the loss resulting from evaporation, and the soil is aerated and the natural agencies stimulated to make plant food available. Realising these facts, it can be readily understood how important a part "intertillage"—or cultivation between the drills—plays in the production of this crop, and especially where the summer moisture is limited.

It may be advisable to cultivate the soil before the young plants have appeared above the ground, if warm rains have occurred and the weeds are germinating rapidly. Such instances are likely to be rare. Almost invariably, however, it will be found that intertillage is desirable as soon as the rows of plants can be seen, and this should be continued as often as may be necessary to keep down weeds and maintain a loose layer—a "blanket mulch" of earth on the surface.

The cultivations should begin soon after the seed is sown and continue until nearly as high as a man's head. A light spike tooth harrow can be run over the crop until the plants are about six inches high, after which a single horse cultivator, which will go between the rows or a two-row cultivator, which will straddle the rows, should be used. The depth of cultivation should be from two to three inches. Deeper cultivation is likely to injure the roots which grow within a few inches of the surface and soon extend from row to row.

Under most conditions three or four cultivations will be sufficient, though occasionally more will require to be given. A badly prepared seed bed, a heavy growth of weeds, and frequent showers will increase the number necessary for the best results.

For areas up to 10 or 15 acres the single horse hoe or cultivator, similar to that shown in the illustration, is very suitable. This is light to handle, and with practice a smart driver can become so expert as to destroy frequently weeds which may be found growing between the individual plants in the drill.

For larger areas than 15 acres a double-row cultivator of the same type, and which will straddle the rows, can be obtained.

Harvesting.—When required for grain the most common practice is to allow the crop to stand in the field until the grain is quite ripe, a condition which is indicated by the husks becoming dry and hanging down. These are then gathered by hand and husked in the field or in the barn.

Unless the grain is quite dry when gathered it should not be stored away with the husks on, as it is likely to heat and mould. Until thoroughly dry the cobs can be stored only in open sheds which admit of a free circulation of air.

After the ears are husked and the grain thoroughly dry, they require to have the grain shelled off them. This is done slowly by holding the cob in one hand and forcing the grains off with the thumb and palm of the other hand or by the core of another cob. Shelling is done more expeditiously by maize shelling machines operated by hand or power.

The maize grain is a very concentrated form of food, similar in value to wheat. On account of its hard character it is usually cracked before being

fed to stock. It is extremely useful for feeding to farm horses, and has not the same injurious effects as is experienced with wheat. Large quantities are, however, somewhat heating, though in some parts of the Eastern States it is practically the only grain fed to horses which are working hard.

For best results, as a concentrate for milking cows, it requires to be mixed with some more nitrogenous food, such as peas.

"Wellingrove" Maize. Busselton Area, W.A.

For pig raising, the twin ally of milk production, maize grain ranks very high, and is complementary to the separated skim milk left on the dairy farm, as this is rich in proteins and ash, and in consequence balances the maize, which is rich in carbohydrates.

The "core" or "cob" has a slight feeding value. Some farmers grind the whole of the ear, *i.e.*, the grain and the cob, together, and the meal thus produced is then known as "Corn and Cob" meal. It is difficult and expensive to grind the "core" to a reasonable degree of fineness, and it is somewhat doubtful whether the feeding value of the "core" is worth the cost of grinding. In this connection it is believed that the principal function of the "core" in such meal is to lighten the mixture, thus facilitating the digestion of the ground corn grain.

The unit by which maize grain is sold is the "bushel." The bushel proper is a measure of capacity, but maize is not measured but weighed, and the term "bushel," as understood in connection with maize, is a conventional one and means 56lbs., which is the approximate weight of a measured bushel

of grain. To sell a bushel of maize is therefore to sell 56lbs. weight. About 75lbs. weight of "ears" will produce about 56lbs. (1 bushel) of grain.

The stalks and leaves—"stover"—which are left after the "ears" have been removed contain about one-third of the total food produced by the plant. Therefore much will be lost if this is not saved. If left in the field its food value rapidly diminishes. Because of this the more modern practice is to cut the crop (stalks and grain), after the grain has commenced to colour and dent, and tie in bundles and stook until the grain is dry and the stalks cured, say, five or six weeks. The cobs are removed and the fodder stored away until required.

The "stover" is not as valuable as the maize fodder, but is very useful for idle horses, and for the maintenance of dry cattle over the winter. Its value is enhanced when the stalks are run through a chaff-cutter or shredded, *i.e.*, dealt with by a machine which tears the stalks into strips or shreds, and known as a "shredder." Machines are now available which will take the corn stalks with cobs attached and deal with the whole material, husking and shelling the cobs and shredding the grain in one operation.

Henry, in his "Feeds and Feeding," has pointed out that the results of experiments conducted by Ladd, at the New York (Geneva) Experiment Station, show that the nutrients in a crop of maize increase very considerably from the time of tasselling and when ripe. When tasselled the crop weighed nine short tons (18,045lbs.) more than eight of which were water. The weight of the crop continued to increase until the grain reached the full milk stage, after which it decreased. Between the milk and glazing stage there was a loss of water, but a remarkable increase in quantity of nutrients, as shown by an increase of over a ton of dry matter in 17 days. From the glazing period until fully ripe there was a further slight increase in nutrients.

The results show that through the various stages until the "glazed" period there is a constant and considerable increase in the nutritive value of the plant. Because of this the crop intended for fodder should not be harvested before the grain is glazed. For silage purposes it should not be delayed beyond this period, as the plants then contain the proportion of water required for good results.

The green crop can then be cut with a short scythe, cane knife, or hoe. For large areas a special machine known as a "maize harvester" is on the market. This machine cuts the stalks and binds them into bundles, just as the reaper and binder deals with the wheat crop. The advantages of such a machine when making silage are obvious.

For silage the green material is placed at once, preferably chaffed, into the "pit," "trench," or "above ground" silo. It is important for those who have silos to realise that if desired the material can be used from the silo immediately, and in this way the silo acts as a store house to enable a green crop to be harvested at its most nutritive stage, and used whilst in that condition.

The green fodder can be made into good coarse hay, and for this purpose should be tied into handy size bundles or sheaves, and a number of them say, five to seven, stooked together in the field until thoroughly air dried. It should then be placed under cover and chaffed before being fed to stock.

The disadvantage of making it into hay is the long period necessary for curing—five or six weeks—during which time a considerable amount of food material is lost.

Valuable as the maize fodder is, it must be recognised that it is not a complete food in itself for dairy stock or working animals. Just as bread forms a very solid foundation in the dietary scale of human beings, so maize fodder, whether as silage for milch cows or hay for horses and dry cows, can play a similarly useful part in the rations of farm animals. Even well-cared-for "stover" has a greater feeding value than is generally believed, and is most suitable for idle stock during the winter. All forms of maize fodder can be utilised to supply in a cheap way the bulky and carbonaceous part of the food required by milking cows. To obtain the great benefits capable of being derived from its use with milking cows or young stock, it requires to be fed in conjunction with some legume, such as clover or lucerne, which should be grown on the farm to maintain, and even increase, its fertility and at the same time supply the protein and ash, the food constituents in which maize is somewhat deficient.

DRY TREATMENT FOR PREVENTION OF SMUT.

This method is rapidly supplanting the old methods, and Western Australia probably leads the other States of the Commonwealth in this direction. Last year seven and a-half tons of copper carbonate were sold for this purpose to Westralian wheat growers. The new method has no injurious effect upon the grain or the young plant as it grows; it is simple and requires only that carbonate of copper at the rate of two ounces per bushel shall be mixed thoroughly with the grain. When carried out in this way it is as effective as any method, but need not be expected to achieve the best results if "slip-shod" methods are adopted. For this reason attempting to treat the seed when it is in the box of the drill is unsatisfactory, for it is impossible by this method to treat each grain with the fine particles of copper carbonate.

WHEAT AND FALLOWING.*

By Professor Paterson,
of the University of Western Australia.

In this paper, which was contributed by Professor John W. Paterson, of the University of Western Australia, a strong plea was put forward for greater discernment in interpreting the benefits of fallowing. Thanks to the active propaganda work of departmental lecturers and writers, and the equally effective methods of the agricultural Press, the general advantages of fallowing were now widely appreciated. It was becoming apparent, however, that much of this propaganda work was too general in its treatment of the subject in that it simply recorded instances of the increased yields from fallowing, elaborated at considerable length a description of cultural methods and their season of application, while it was too little analytical of the reasons leading up to the increased yields. Where reasons came into question it was more or less tacitly assumed that the improvement was due to moisture conservation. This was by no means always correct. For example, in 1923 the W.A. wheat belt had too much rain early in the season, and yet the crops on fallow always appeared stronger and healthier than those on dry-ploughed land. It was not contended that moisture conservation was unimportant—it was frequently most important—but it was not everything.

Fallowing conferred other benefits, any or all of which might contribute strongly to the increased yields. On the heavier soils especially, it would, by the action of time and judicious cultivation, lead to flocculation of the finer clay particles giving a better soil aeration and a good tilth. Again, by spreading the work of the farm it gave more time to plough properly and without scamping—a special advantage on the heavier soils. Further, it helped efficiently to kill weeds—a feature of special import in the older districts. Finally, it assisted powerfully in providing within the soil a supply of nitrates ready for the next crop. Nitrate supply might frequently be the principal cause of improved yields from fallow. Along with Mr. P. R. Scott, of the Victorian Department, he had in 1912 ascertained that a good fallow at Geelong was able to prepare 148 lbs. of nitrate nitrogen per acre, as compared to 32 lbs. on land which had been under crop the previous season. This difference of nitrates in favour of fallow would become still greater in districts enjoying no—or only sparse—summer rains. Where crop had to be seeded on dry-ploughed land, and especially under good winter rainfalls, 20 to 30 lbs. sulphate of ammonia might be added to the superphosphate dressing.

In conclusion the Professor claimed that the gross benefit of fallowing was a composite result of various soil improvements effected by cultivation and rest. In no case would the improved yield be due solely to moisture conservation, improvement of soil texture, killing weeds, or to nitrate production, but the relative importance of these would vary with each particular district and season. Insistence on the general benefits of fallowing without specific reference to the reasons was unscientific: it conveyed no intelligent information to the farmer, and might even deter him from seeding unfallowed land for no better reason than that he had been advised against it.

* Read at the Adelaide (August 1924 meeting of the Australasian Association for the Advancement of Science.

BROOM MILLET.

F. J. S. Wise,
Adviser on Tropical Agriculture.

Broom Millet is a non-saccharine variety of sorghum. It is an annual, somewhat similar to maize when young, but, like the other sorgums, is much hardier, and will stand far drier conditions.

The great diversity of soil and climate met with in this State makes it possible to produce many of the sorghum family satisfactorily and profitably. Sorghums, generally, as a utility crop for the farmer, are very neglected, and as a profitable sideline one of the family—broom millet—has many attractions. There is no reason why more than the requirements of this State should not be produced locally. The present is an excellent time to increase our production, as prices are so favourable to this crop being grown with profit.

The increase in price is due to the demand for good fibre within the whole Commonwealth, as well as in this State individually, where, up to the present, the supply has been inadequate to the wants of the broom manufacturers.

Useful portion of the Plant.—The fine stems of the seed head are the valuable portions of the plant, and the formation of a good "brush" depends on the length, colour, size, and strength of these stems. It is not essential to have strong, leafy growth to promote the best growth of these seed heads, nor to have a heavy crop of seed to produce the long thin seed stems of which the brush is composed.

Soils.—A variety of soils will produce good quality brush, but the conditions needed to promote the best growth are well-drained alluvial lands, although sandy soils produce first quality brush if proper care and attention are given. An instance of this was obtained last year in the North-West where, on the light sandy soil, commonly known as "Pindan," at Beagle Bay, an excellent growth of cover brush was grown last year. Brush of the type grown is worth £40 per ton at present.

As a subsidiary crop for the farmer in suitable locations in this State, Broom Millet can be considered as a crop to take the place of maize in the planning of the operations of the farm. It has, in common with other sorghums, the ability to withstand droughty conditions, and to produce fair crops in seasons when maize would not mature.

Preparation of Land.—Thorough preparation of land, preferably some time before planting, is very necessary; deep ploughing coupled with good surface working will give the crop every assistance to withstand seasonable reverses and irregularity and shortage of rain.

Manuring.—Like maize and other sorghums, this plant will respond to heavy manuring, and coarse manures like green stable manures are suitable. Because of this it is a very suitable crop to succeed a crop of cowpeas

or subterranean clover. An application of about 2cwt. of superphosphate per acre is recommended, supplemented with, say, ½cwt. of sulphate of ammonia to stimulate the early growth, as this plant is slow to start.

Planting.—Planting should not be attempted before the ground is warm, and in Southern areas or cold districts where frosts occur, operations cannot be attempted until frosts are over. Plant in shallow drills 3ft. 6in. or 4ft. 6in. apart, according to situation and quality of soil. The seed may be sown either by hand or with a machine. The ordinary maize planter fitted with suitable plates is very useful for this purpose. Machine planting is preferable, as it sows uniformly and presses the seed into the soil and compacts the latter about it, thus assisting in quick germination. The seed is sown thick enough to permit of the young plants when about 1in. to 8in. high being hoed out to about 4in. to 6in. apart in the drills on rich soil, and a proportionately greater distance for lighter or sandy country. Good sound seed may be sown so that very little thinning is necessary. From 4lbs. to 8lbs. per acre is required.

It is not anticipated that any farmer will deal with this crop over a large acreage, but if heavy plantings are made by an individual, it will be necessary to make a succession of sowings to avoid having the crop all maturing at the same time.

Thinning out and Intertillage.—When the plants are showing signs of vigour (they are rather slow for two or three weeks), and have reached a height of say, six to eight inches, they should be thinned out. Good thinning out is reflected in the quality of the brush produced; a thick stand usually means spindly and weak thin brush.

Good cultivation of the soil between the rows (known as intertillage) is necessary to keep down all weed growth, and to keep all available moisture in the soil. The intertillage should commence early, and should continue until the seed heads are forming. At this latter stage the plant requires good conditions for growth, as the brush is directly affected by reverses at this stage. A well-cultivated moist soil will help the plant over this period.

Bending down the Heads.—This consists of bending down the seed head at about a foot below its base, so as to take advantage of the weight of the seed to cause the brush to hang straight. Though good broom is grown without bending down the heads, yet this is an operation that should never be neglected, as if the brush is allowed to mature in a natural way the head will spread out and reduce its market value, and is likely to render it useless. The bending is done when the seed is in the milky stage and beginning to fill out. It is necessary to bend between the joints or nodes of the stem to prevent breaking off. Bending down is almost universal in America, but some Australian growers neglect this operation, and invariably have large percentages of their crops spoilt.

Harvesting.—The time for harvesting depends on the prevailing weather and the demands of the market for colour. It is generally recognised that millet having a green tinge is tougher and more sought after by manufacturers.

In harvesting the brush, if two rows of plants are being dealt with, a good method is to first remove the heads, then bend the stalks towards each other to form a "table" or "platform," on which the heads can be left to

dry in the field. This "table" keeps the brush clear of the ground and makes handling easier. About six or eight inches of stalk should be cut with the brush. After harvesting the brush requires to be dried.

An instance where breaking down would have been profitable.

Broom Millet with head bent down.

Drying is most successful when carried out in barns or under shelter houses, but in clear fine weather up to four days in the field will dry it out sufficiently, and not cause much bleaching or discolouration.

The removal of the seed is done by a "hackler" or header or spiked drum turned at a high speed. A home-made contrivance is simply constructed. Such a machine consists of a tough wooden drum about 18 inches long and 15 to 18 inches in diameter, bound at each end to prevent splitting with an iron hoop, in the same way as the hub of a waggon wheel is bound. Stout nails with their heads cut off are driven at regular but "staggered" intervals, leaving a small space between each. This is mounted with steel axle, and revolves in wooden or other bearing placed in a stout frame high enough for easy turning. It requires to be driven at a high speed, and this is attained by attaching the handle to a large cog-wheel which engages with a much smaller one fixed to the spindle of the drum. Small quantities can be threshed by drawing the heads through an iron comb or by holding the heads over a beam and beating them out with a stick.

Grading.—After harvesting the brush should be sorted and packed according to its quality.

Grading the cured brush is one of the most important operations of the grower. Honest, careful grading improves his prices in any market.

Three grades are usually marketed, known in the trade as "Inside," "Cover," and "Hurl."

"Inside" millet is used for the middles of brooms, and is generally from 13 to 16 inches long.

"Cover" is used for forming the shoulders of the broom, and for the intermediate layer. It is usually 16 to 20 inches in length.

"Hurl" is the primest and longest brush, and ranges from 20 to 24 inches in length.

Yield.—In the Eastern States the yield ranges from eight to 16cwt. of marketable brush per acre. At present prime hurl is worth £40 per ton in Sydney. The seed has a little commercial value. This sells readily for poultry foods at prices varying from 1s. 6d. to 2s. 6d. per bushel.

Future for the Industry.—It is possible for the farmer, with suitable climatic and soil conditions, to supplement his income by the production of an acre or two of this crop. There is at present a general shortage in the Commonwealth. For export purposes prim hurl and cover brush are most in demand. The millet should be well cured, graded, and baled when grown for export. American growers find very profitable markets in New Zealand, England, and in European countries. In this State the W.A. Brush Company use up to 50 tons per annum, almost all of which is brought from the Eastern States. Prices paid vary from £35 to £50 per ton.

TOBACCO GROWING AND CURING.

A. R. C. CLIFTON,
Officer in Charge of Irrigation.

The cultivation of tobacco in Western Australia was probably first attempted at the time of the Civil War in America, which caused a "tobacco famine" in this State and, as a result, some of the early settlers endeavoured to produce their own. However, this seems to have been more or less a failure, due, no doubt, to lack of knowledge.

The shortage did not continue for a very lengthy period, and the imported article coming on to the market again, appears to have removed the inducement for further efforts. Though small plots were still grown, the tobacco was mainly used for spraying and dipping purposes.

In more recent years individual settlers have been experimenting with the bright types and, although favourable reports as to quality, etc., have been received from time to time, no quantity has ever been placed on the market.

Last season the Department decided to conduct experiments in the South-West, in order to determine the possibility of growing tobacco commercially in that district and to select a suitable variety. As there is a demand for a light pipe and cigarette leaf, the following varieties of this class of tobacco were tried:—

Spotted Gum;
Yellow Pryor;
Dungowan;
Dunbur;
Hester;
Warne; and
White Stem Orinoco.

The plants were raised in the Government Gardens, Perth, the seeds being planted in July, August and October. Owing to the exceptionally wet and cold September the October sowing proved the most successful, as the germination was excellent and the seedlings made vigorous growth with the advent of the warmer weather, thus receiving no set-back as was the case with the earlier sowings. The plants were all reared in the open and were particularly healthy and hardy. There was no trace of disease, the only trouble experienced in the seed beds being caused by looper caterpillars which played havoc with the first plantings. The seedlings were pricked off into trays and despatched to the different plots, which were planted at the end of November.

Plots were tried at the following places:—

Peel Estate—On grey, sandy semi-swamp land;
Coolup—Grey sand with a clay subsoil;
Boyanup—Grey sand with a clay subsoil;
Bridgetown—Light, sandy soil.
Manjimup—Light, sandy soil.

One-fortieth of an acre of each variety was planted in each plot.

At Manjimup the Cutworm was bad, but these were got rid of by the application of poisoned bran. Grasshoppers also, at Manjimup, Bridgetown, and Boyanup, did a certain amount of harm. On the Peel Estate the Potato Moth caused some damage, but the latter would probably have been obviated had the plants been out earlier.

The following fertiliser mixture was used:—

Sulphate of Ammonia—40 lbs.
Super—40 lbs.
Sulphate of Potash—32 lbs.

and this was sown at the rate of 7 cwt. per acre. The Manjimup and Bridgetown plots had also a top dressing of lime.

The summer was exceptionally dry, the total rainfall from December to March averaging only 106 points. The Peel Estate was the highest with 146 points, and Bridgetown the lowest with 71 points. As this rain was distributed over the growing period it was of practically no value.

The average points of rainfall for the different centres and the rainfall for the period under review is given below:—

District.	Year.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.	June.	Total.
Perth	Average 75 years	650	564	342	211	77	59	34	46	77	162	494	693	3,409
Do.	1923–1924 ...	458	391	784	248	4	88	30	13	40	...	...	...	...
Mandogalup (Peel Estate)	No previous record.													
Do.	1923–1924 ...	375	395	709	227	17	65	28	8	45	...	...	...	...
Pinjarra (Coolup)...	Average 78 years	707	639	373	258	94	63	35	45	84	180	535	758	3,771
Do.	1923–1924 ...	390	426	745	279	11	3	32	23	26	...	...	...	...
Boyanup	Average 26 years	746	611	425	291	112	65	59	73	114	169	544	783	3,992
Do.	1923–1924 ...	467	550	679	212	21	14	35	30	39	...	...	...	...
Bridgetown ...	Average 36 years	574	516	387	292	111	82	55	67	103	165	453	593	3,398
Do.	1923–1924 ...	564	470	676	114	24	9	18	37	7	...	...	...	...
Manjimup ...	Average 8 years	715	712	479	324	150	108	101	162	123	228	544	718	4,364
Do.	1923–1924 ...	614	522	869	104	125	*Nil*	61	38	24	...	...	...	...

Owing to the dry conditions the plots at Coolup and Boyanup were a complete failure in spite of every care and attention being given by the settlers on whose holdings the trials were conducted. The plots at the Peel Estate, Bridgetown, and Manjimup survived the dry conditions but, as a result, made very poor growth.

The Manjimup plot was on Mr. Murphy's block, Group No. 5, and adjoining the experimental plot he and his neighbour, Mr. Limmer, planted an acre of tobacco between them. At the end of March these settlers attempted to cure about 1,000 leaves in an improvised barn, the growth of this crop not being sufficient to warrant the erection of an up-to-date structure. It was impossible to completely cure the leaf owing to the adverse conditions under which they were working, and the process was only carried to the second stage when the flue collapsed. Great credit is due to these settlers, as this work was all done after group hours.

A local manufacturer expressed surprise at the quality of the leaf and gave the following report regarding it:—

Burning quality—good.
Aroma—good.
Texture—good.
Mellowness—excellent.

As the leaf was only partially cured he was not in a position to give a definite opinion, but considered that after fermentation it would prove a most desirable type of cigarette leaf to handle.

The main object of this experiment, which was to determine whether tobacco could be commercially grown in the South-West, was not achieved on account of the droughty conditions under which it was conducted.

The variety which proved the hardiest was White Stem Orinoco, and a small quantity of this seed has been secured for distribution. However, other varieties may prove equally good and perhaps better under more favourable conditions.

To be successful intending growers must have their plants ready for planting out as soon as possible after the danger of frost is over, say, in October. To do this it is necessary to plant the seed beds early in August and to raise the seedlings under cover. It is a wise precaution to have at least one or two relay beds to guard against accidents. One-twelfth of an ounce of seed is sufficient for 10 square yards of seed bed and will plant approximately one acre. However, provision should be made for 50 per cent. more than required.

The most suitable land for light tobacco is light sandy soil containing humus and with good natural drainage. It should also be fallowed and limed. As soon as the dry weather commences thorough cultivation is essential to retain the moisture.

Fertiliser should be applied and lightly ploughed in at least a fortnight before planting out. The different manures and quantities required can only be determined by experiment, but superphosphate is very necessary in the production of bright leaf.

If success is to be achieved with the tobacco industry particular attention must be given to the curing, as this is the most important process in connection with its production. The trade requires a light flue-cured leaf, and growers should endeavour to supply this. In America barns are purposely built small, the reason being that unless the barn is filled in 12 hours and the firing begun immediately, it is not possible to get a uniform colour in the cure. Another reason is because of fire. The loss of a barn containing the crop from one acre would not be so disastrous as one containing that from a larger area or, perhaps, the whole crop. The cure is also more rapid, more uniform, and more perfect in the smaller barns.

On pages 273-6 will be found plans and specifications supplied by the Public Works Department, showing a flue-curing barn capable of holding an acre of tobacco. One of these barns is required for every five or six acres. The estimated cost of materials for this is £150 F.O.R., Perth.

The agent for curing is dry heat made by means of flues running around the floor of the barn heated by a furnace fed from outside. A thermometer is necessary inside the barn to determine the degree of heat.

The following formula, according to Mr. Temble A. J. Smith, the Tobacco Expert of Victoria, is looked upon as the safest, but there are many modifications, as it is not possible to give a hard and fast rule for curing all kinds of light tobacco, though the different systems have been evolved from the same basis.

The first process, known as yellowing, takes from 24 to 36 hours. During this period certain chemical changes and slight fermentation take place. The vents are kept closed and the temperature is kept at from 85deg. to 100deg. F. until the leaf sweats, when the vents are opened top and bottom. At this stage the leaf should have assumed a yellow colour.

The next stage is to fix the colour by driving off the moisture in the leaf as fast as it is given off. This is done by slowly raising the temperature to 120deg. over eight to twelve hours. If the temperature is increased too fast without sufficient ventilation, the moisture driven out of the leaf is not carried away fast enough, and causes brown patches. If it is increased too fast with ventilators open, scorching is liable to occur, and if too slow the leaf will, by oxidation, turn brown or red. This is the critical part of the cure, and as the moisture in the tobacco varies according to the season, the curer must watch the regulation of both temperature and ventilation, so that the excess moisture is removed just as fast as it is given off by the leaf. When the blade of the leaf has been dried out, the critical stage is past.

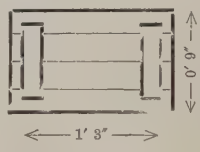
The third stage, known as killing the leaf, takes from eight to ten hours, and the temperature is raised slowly to 125deg. F. when the life of the leaf is killed.

The fourth stage takes from seven to eleven hours, when the mid-rib and stalks are dried out by raising the temperature at the rate of 5 deg. per hour to 160deg.-180deg. F. until the whole is completely dry. The cure is then effected.

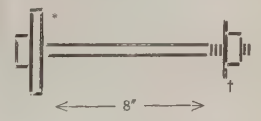
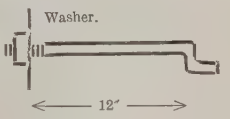
Further information on the treatment of tobacco will be found in Bulletin No. 74 issued by this Department.

As tobacco is an excisable commodity it is necessary for intending growers to keep certain prescribed records and to be registered as producers. Application must be made to the Collector of Customs, Fremantle, from whom the necessary forms may be obtained. No fees are payable in this respect, but unless this regulation is complied with growers are liable to a penalty of £20.

MATERIALS FOR TOBACCO CURING BARNS.

Item No.	Description.	Size in inches.	Quantity and Remarks.
	SAWN JARRAH.		
1	Bottom Plates	4 x 3	4/17.
2	Studs (at angles)	4 x 4	2/19, 2/16.
3	,, Intermediate	4 x 2	20/19.
4	,, Front	,,	7/16.
5	,, to Door	,,	1/12, to cut Trimmer and Stud.
6	,, over Door	,,	1/13.
7	,, to bolt to Front Wall ...	,,	1/8, to carry ends of boards.
8	Trimmers, etc.	,,	50 lin. feet, to cut Trimmers for Roof Vents and Vents on floor line, etc.
9	Studs on Centre Line	4 x 3	3/23.
10	Sole Plates to Centre Line ...	4 x 2	3/6.
11	Struts to Centre Line	,,	3/8.
12	Top Plates	,,	2/19, 2/17.
13	Tier Rails	,,	20/17.
14	Tie and Tier Rails	,,	5/17.
15	Piece above Top Rail	3 x 2	2/17, to cut in between Ties.
16	Rafters	4 x 2	18/11.
17	Collars	,,	3/11.
18	Studs to Gables	,,	7/7.
19	Braces	3 x 1	2/23, 6/26.
20	Ridge	8 x 1	1/19.
21	Angle Stops	3 x 1½	2/20, 2/16.
22	Sawn Dry Boards	6 x 1	46/19, to Roof.
23	,, ,, ...	,,	168/17, to Walls.
24	,, ,, ...	,,	200 lin. feet, to Gables.
25	,, Weather Boards (parallel)	7 x ⅝	168/17, to Walls.
26	,, ,, ,, ,,	,,	200 lin. feet, to Gables.
27	Linings to Door and Roof Vents	6 x 1½	1/17, 4/8.
28	Door Stops	2 x ½	1/17.
29	Ledged and Braced Door ...	6ft. 8in. x 2ft. 8in. x ⅞in.	With T. and G. and V.J. Sheeting.
		No. 1.	
30	Small Ledged Doors, with T. and G. and V.J. Boards	1ft. 3in. x 0ft. 9in. x ⅞in.	For Vents in Floor Line as sketch :— 
		No. 9.	
31	18in. Scotch Tee Hinges and Screws	18in.	1 pair.
32	6in. Strong Japanned Tee Hinges and Screws	6in.	9 pairs.
33	Carpenter's Rim Lock and 2¼in. Furniture	6in.	1.
34	D.H. Nails	2in. x 10G.	25 lbs.
35	,, ...	2½in. x 10G.	45 lbs.

MATERIALS FOR TOBACCO CURING BARNS—*continued.*

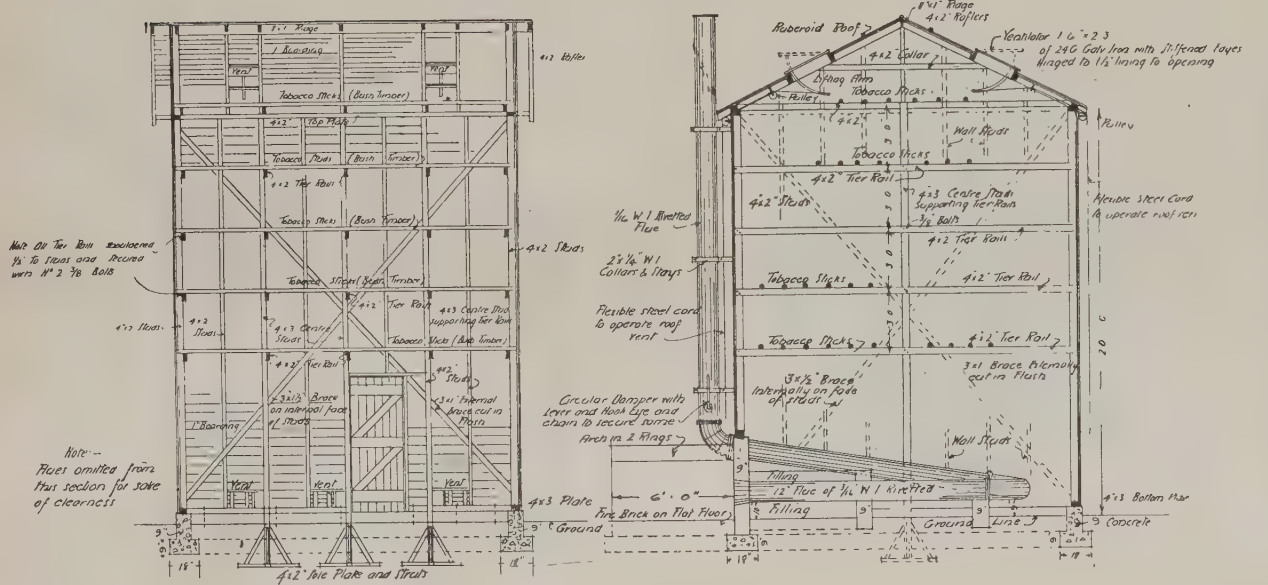
Item No.	Description.	Size in inches.	Quantity and Remarks.
36	D.H. Nails	3in. x 9G.	14 lbs.
37	„	3½in. x 8G.	7 lbs.
38	„	4in. x 7G.	7 lbs.
39	Galvanised Flat Heads	¾in.	7 lbs.
40	Sq. Head Bolts and Nuts ...	6 x ⅜	180, 2 washers to each.
41	„ „ „ ...	4½ x ⅜	60, 2 washers to each.
42	„ „ „ ...	5½ x ⅜	30, 2 washers to each.
43	„ „ „ ...	8 x ½	4, for securing short uprights to brickwork.
			
44	H.D. Crank Bolts	12 x ½	21.
			
45	P. and B. Building Paper ...	...	1½ rolls.
46	Ruberoid (3-ply)	...	50 sup. yards, with necessary solution for fixing, etc.
47	Mixed Paint	...	½ gallon.
48	Blue Metal	2in. all in	5⅓ cub. yards for concrete.
49	Cement	...	18 bags.
50	Wire Cut Bricks	...	1,500.
51	Fire Bricks	...	1,500.
52	Fire Clay	...	10 cwt.
53	Lime	...	5 bags.

* 3″ x 2″ x ¼″ washer. † Washer.

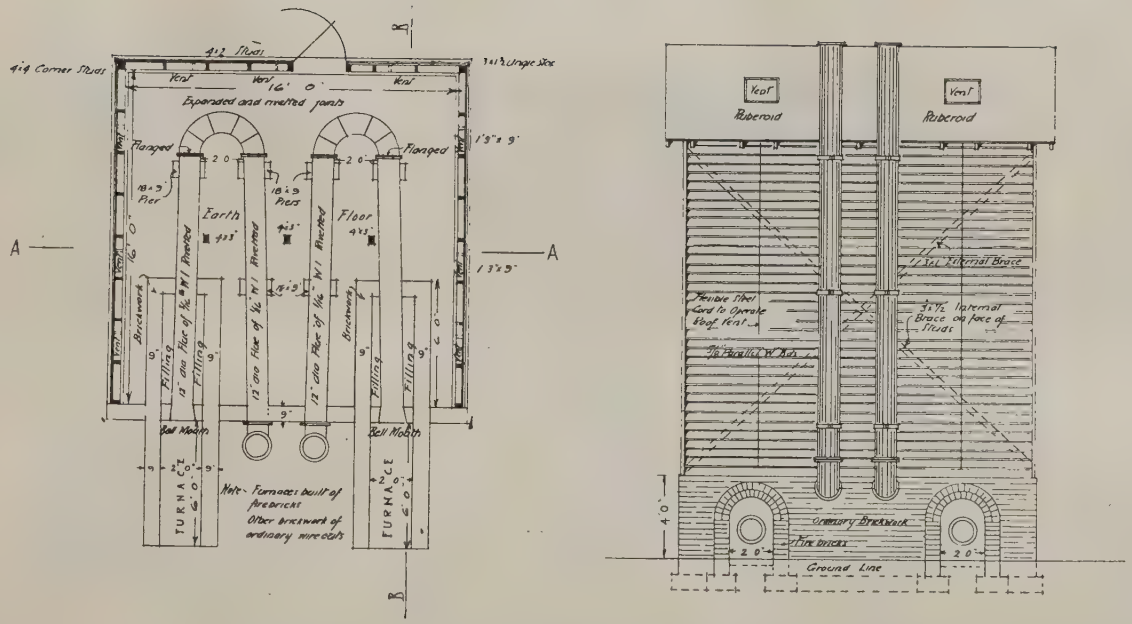
MATERIALS FOR TOBACCO CURING BARNS—*continued.*

Item No.	Description, Size in inches, and Remarks.
	No. 2 SETS AS DESCRIBED BELOW.
	1/16IN. W.I. PLATE RIVETTED FLUES AND SMOKE STACK, 12IN. INTERNAL DIAMETER.
40	12in. diameter Smoke Stack, approximately 20ft. high, as shown in Fig. 1 at (A) with flange on bottom to connect with bend. No. 1.
41	12in. diameter Bend (see Fig 1 at B), with flanges. Made up in sections and rivetted. No. 1.
42	12in. diameter Bend (see Fig. 2 at C), with flanges, made up in sections and rivetted. No. 1.
43	12in. diameter Flue, to be fixed on angle (see Figs. 1 and 3 at D), with flanges and approximately 13ft. long. No. 1.
44	12in. diameter Flue, to be fixed horizontally (see Figs. 1 and 3 at E), and having bell mouth at outer end all rivetted together, and with flange at opposite end to connect with bend, approximately 12ft. long. No. 1. This item in $\frac{3}{16}$ W.I. Plate.
45	Damper (full way), as shown in Fig. 1 with operating lever, and all necessary fittings to connect to smoke stack (with suitable chain and eye bolt) for regulating same. No. 1.
46	Bolts and Nuts (necessary) for Flanges to above to be included with order. Item.
47	Collars and Stays for Smoke Stack, Fig. 4, including all necessary bolts and nuts. No. 3 for each set.
48	Vents to Roof (see Fig. 5), 2ft. 3in. x 1ft. 6in. wide out of 24G. galvanised plain iron, with strengthening bars rivetted on edges and having suitable back flap hinges rivetted on and secured to linings with stout wood screws. No. 4.
49	Opening Arm, see Figs. 5 and 6, to be fitted to above, and each Vent to be supplied with 2 pulleys, 3in. diameter, with plates and coach screws for fixing to timbers, supply for each: 20 ft. lin. of flexible steel wire with 1 wrought-iron cleat and screws to do. No. 4.

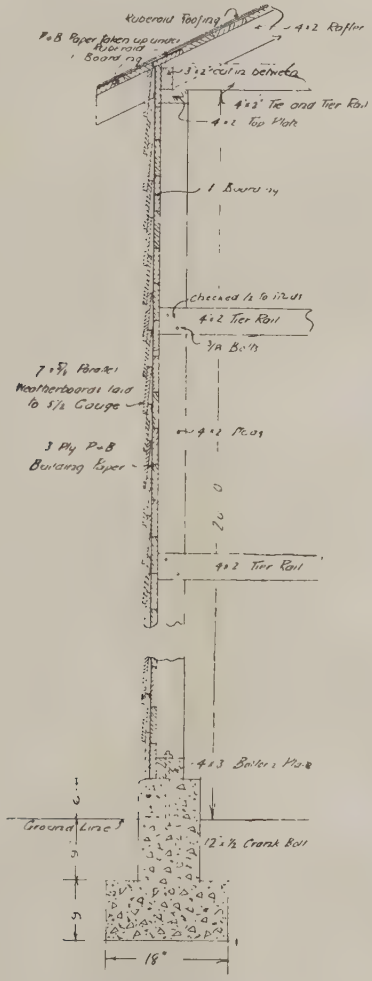
TOBACCO CURING BARN



SECTION ON A·A —— Scale One Inch = 8 Feet —— SECTION ON B·B



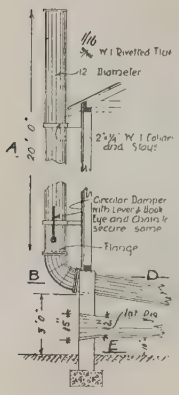
GROUND PLAN — Scale. One Inch = 8 Feet. — SIDE ELEVATION



DETAIL OF CONSTRUCTION

—Scale 1/2 in = 1 ft.—

FIG. I.



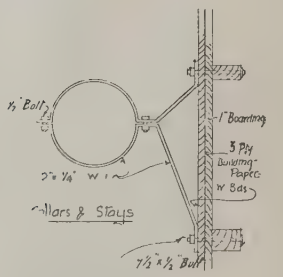


FIG. IV.

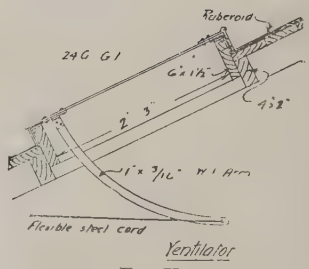


FIG. V.

FIG. II.

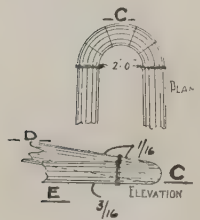


FIG. III.

FIG. VI.

FEED COSTS OF COWS.

West Australian Pure Breeds Official Herd Testing Scheme.

P. G. Hampshire,
Dairy Expert.

In preparing data showing the costs of feeding of all cows under Official Test in Western Australia for the year ending 30th June, 1924, as far as is known the West Australian Department of Agriculture is the first to supply this most important information in respect to Pure Breeds Herd Testing. Certain other States of Australia publish particulars of the monthly feeding of herds and, in cases of particularly high-producing individual cows, the details and cost of feeding throughout the testing period are given, but previously the full details and costs of feeding of all cows under official test have not been supplied.

There is a fairly general impression among dairy farmers that, in Pure Breeds Herd Testing, the feeding costs are out of proportion to the returns received, and that it would not pay the commercial farmer to keep these pure bred high-producers. The accompanying table, which sets out the data in regard to milk and fat production and costs of feeding, and shows the margin of profit over feeding, very effectively refutes the false idea that Pure Breeds Herd Testing does not pay, as far as Western Australia is concerned at all events. It will be further understood why this Department is anxious that young bulls from these profitable "above standard" cows should be used to mate with the average cow of this State to improve the progeny, and help to lift the low average cow production to a more profitable basis.

It will be seen that the average profit over costs of feed of all cows under official test is £18 14s. 8d. This figure includes every cow tested. Profit over feed costs ranges from £11 13s. 3d. per cow per herd to as high as £27 17s. 3d. per cow per herd. Herd "A," with 16 lactations of nine months, shows an income of £445 16s., and, if we add the value of the yearling calf at £20 each, after deducting feed costs—not a high figure for a herd of cows that average 430.3lbs. of fat—we obtain the excellent result of £765 16s. from 16 cows after paying for their feed. A herd of 20 average cows under test, at the average income as shown by the table, £18 14s. 8d., would return £374 13s. 4d. over cost of feed, without taking into consideration the value of the progeny at, say, £15 each—£300, which would increase the total annual income to £674 13s. 4d. These are not estimated or imaginary figures, but actual results of the past year's herd testing.

The tabulated results given provide knowledge for careful study in order to fully appreciate the information contained. The various columns show the herds represented, the average fat produced by each cow in the herd, value of fat each cow in the herd produced at average price ruling during the period, quantity of skim milk available for feeding pigs after deducting 10 per cent. of the total milk as cream, and 180 gallons of skim milk estimated as required to feed the calf, value of the skim milk after the former deductions, the average value of production of each cow in each herd. The

Ten Cows from Herd "A," owned by Mr. R. H. Rose, "Grassvale," Burekup, W.A. These ten cows yielded 201½ lbs. of butter fat in 24 hours, and are placed in order of merit, reading from right to left—the leader yielded 3.176 lbs. of butter fat in 24 hours, and in

next column shows the total cost of feed given to cows during the period—this is obtained by the strictest supervision by the official testers and charged at the average annual market rates (on the farm), prices being secured from

PARTICULARS OF PRODUCTION, FEED COSTS, AND PROFIT OF HERDS UNDER OFFICIAL TEST.

Year ending 30th June, 1924.

Herd.	Average Fat per cow per Lactation Period (9 mths.).	Value of Fat per cow at average price 1923-4, 1s. 7¾d. per lb.	Skim Milk per cow after deduction for cream and feeding calf.	Value of Skim Milk at 2d. per gallon.	Total Production Credits.	Cost of Feed per cow for period.	Profit per cow for Lactation period.	Cost of Feed per 100lbs. Fat produced.	Value of 100lbs. Fat at 1s. 7¾d. per lb.	Profit per 100lbs. Fat.	
										Less Skim Milk.	With Skim Milk.
	lbs.	£ s. d.	gallons.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
"A"	430·32	34 19 3	574	4 15 8	39 14 11	11 17 8	27 17 3	2 15 3	8 2 6	5 7 3	6 9 6
"B"	403·42	32 15 7	453	3 15 6	36 11 1	11 1 6	25 9 7	2 14 11	8 2 6	5 17 7	6 6 8
"C"	382·82	31 2 1	810	6 15 0	37 17 1	20 13 2	17 3 11	5 7 11	8 2 6	2 14 7	4 9 10
"D"	347·29	28 4 4	425	3 10 10	31 15 2	8 5 7	23 9 7	2 7 8	8 2 6	5 14 10	6 2 10
"E"	331·33	26 18 4	519	4 6 6	31 4 10	10 17 9	20 7 1	3 5 9	8 2 6	4 16 9	6 0 3
"F"	292·32	23 15 0	419	3 9 10	27 4 10	8 4 11	18 19 11	2 16 5	8 2 6	5 6 1	6 10 4
"G"	325·90	26 9 6	320	2 13 4	29 2 10	11 16 7	17 6 7	3 12 6	8 2 6	4 10 0	5 17 4
"H"	318·68	25 17 10	358	2 19 8	28 17 6	11 15 5	17 2 1	3 13 10	8 2 6	4 18 0	6 14 2
"I"	267·43	21 14 6	256	2 2 8	23 17 2	5 17 6	17 19 8	2 3 11	8 2 6	5 18 7	6 14 1
"J"	357·53	29 0 11	413	3 8 10	32 9 9	16 7 1	16 2 8	4 11 9	8 2 6	3 11 0	4 10 2
"K"	322·35	26 3 10	550	4 11 8	30 15 6	18 3 5	12 12 1	5 12 9	8 2 6	2 9 9	3 18 9
"L"	335·00	27 4 5	444	3 14 0	30 18 5	13 7 7	17 10 10	3 19 10	8 2 6	4 2 8	5 4 2
"M"	349·92	28 8 7	434	3 12 4	32 0 11	17 17 1	14 3 10	5 2 8	8 2 6	3 0 6	4 1 1
"N"	330·69	26 17 4	432	3 12 0	30 9 4	15 6 8	15 2 8	4 12 11	8 2 6	3 9 7	4 11 1
"O"	302·19	24 11 0	609	5 1 6	29 12 6	12 3 7	17 8 11	4 0 7	8 2 6	4 1 11	5 15 5
"P"	266·79	21 13 6	300	2 10 0	24 3 6	9 16 1	14 7 5	3 13 5	8 2 6	3 10 7	4 16 5
"Q"	249·78	20 5 10	387	3 4 6	23 10 4	11 9 4	12 1 0	4 11 11	8 2 6	4 15 2	5 17 7
"R"	198·34	16 2 4	267	2 4 6	18 6 10	6 13 7	11 13 3	3 7 4	8 2 6		
Averages	319·50	25 19 2	362	3 0 4	28 19 6	10 4 10	18 14 8	3 4 1	8 2 6	4 18 5	5 17 3

Number of Lactation Periods (9 months) ... 155.

AVERAGE COST OF FEEDS.

Wheat, 4s. 6d. per bushel; Oaten or Wheaten Chaff, £3 10s. per ton; Bran, £6 5s. per ton; Pollard, £8 5s. per ton; Crushed Oats, 3s. per bushel; Linseed, £13 10s. per ton; Lucerne Pasture, 3s. per week; Lucerne Hay, £7 per ton; Maize, green, 7s. per ton; Silage, 10s. per ton; Brewers' Grains, 6d. per bushel; Pasture, 1s. 6d. per week; Sudan Grass Pasture, 3s. per week, or 7s. per ton; Lucerne, green, £2 per ton.

reputable produce merchants. It was necessary to estimate the values of such items as grazing certain crops, and cost of pasture per week, which are shown. It would appear at first glance that the charge for pasture is

low, but it will be understood that the quality and quantity of pastures varied considerably; the charge, therefore, must be considered a fair average one. "Profit per cow for lactation period" represents the nett return each cow in each herd produced over cost of feed. Column—"Cost of feed per 100lbs. of fat" is a new aspect of judging the feeder (or owner) as well as the economy of the cow as a producer of fat, and must be compared with the "Average yield of fat per cow" and "Value of 100lbs. of fat." Column—"Value of 100lbs. of fat" is constant; and the last two columns show the nett profit per 100lbs. of fat produced over cost of feed. A careful study of the average amount of fat produced, with the cost to produce 100lbs. of fat, should be made. This aspect shows us where certain cows have been expensively and wastefully fed, where other cows apparently have been underfed, and where high average production has been secured at a reasonable cost per 100lbs. of fat, or economy of feeding.

There are many lessons to be learnt by the data obtained—good cows, bad cows, overfeeding, underfeeding, and economy of feeding, and particularly the splendid income to be obtained from good cows.

F.A.Q. STANDARD.

Amount of Red Grain in F.A.Q. Standard—
600 grammes clean grain.
5·23 grammes red grain.
Average per 100—·87.

F.A.Q. STANDARD OF WHEAT.

Year.	Western Australia.	South Australia.	Victoria.	New South Wales.	Queensland.	Tasmania.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1910–11 ...	62½	62½	62½	63		
1911–12 ...	62	61½	62½	61½		
1912–13 ...	62	62	63	62¼	No.F.A.Q.	No F.A.Q.
1913–14 ...	61	61½	62½	64	standard.	standard,
1914–15 ...	61½	61	62	60½		Wheat sold
1915–16 ...	60½	62½	61	61		at 60lbs.
1916–17 ...	62¾	62	60¼	56¾		per bushel.
1917–18 ...	60½	60½	60	58½		
1918–19 ...	61½	62	62½	62½		
1919–20 ...	64½	61	62	61		
1920–21 ...	62	60½	60½	59½		
1921–22 ...	63	60	60	60½		
1922–23 ...	62	61½	61¾	61		
1923–24 ...	62¾	61½	61	60½		

THE DEVELOPMENT OF A DAIRY HERD.

(Continued.)

P. G. Hampshire,
Dairy Expert.

Feeding.

We have said that "breeding," "feeding," and "weeding" represent the slogan to remember in developing a profitable dairy herd. Having paid due consideration in the selection of the animals which form the nucleus of the dairy herd and decided upon a sound policy of breeding or "grading up," the next step towards success is "feeding." Some writers stress "feeding" as being the most important in regard to the production of the dairy cow. We, however, consider "breeding" the first consideration, and "feeding" next or the corollary to breeding. It is unsatisfactory to feed a badly built engine with good petrol: feed a well built engine, however, with good petrol and we get good results.

The value of permanent Pasture. Paspalum and White Dutch Clover at Roelands, W.A. The cow shown, "Lyracleas Favourite," owned by Mr. D. J. Goyder, produced 661 lbs. of butter fat in 334 days. Fed mainly off this pasture.

It is well known that a dairy cow must have a sufficiency of suitable feed to produce large quantities of milk, but, unless the animal is "bred" to produce, she is incapable of production no matter how well she is fed.

"Feeding" is the corollary to breeding, and "testing" or "weeding" is the method of checking the economy of feeding and the proof of breeding.

It is not proposed to make this article of a technical character, but rather to interpret the subject to the dairyman in a manner easily understood.

In feeding dairy cows there are a number of factors to take into consideration:—

1. Sufficiency of feed.
2. "Balancing" of feed.
3. Succulency and palatability of feed.
4. Profitable or economical feeding.
5. Conservation of roughage.
6. Feed according to individual production.
7. The "famous five" fodders of financial feeding.

Sufficiency of Feed.

The cow should receive sufficient feed to maintain her bodily requirements and produce her maximum of milk and fat. Probably 25 per cent. of the dairy cows in Australia are more or less starved. They do not receive a sufficient quantity of feed to keep them in good physical condition and enable them to produce profitable yields of milk. A big percentage of our cows are starved, especially for protein foods such as lucerne, clovers, vetches, peas, and bran. It is better to keep a few good cows and feed them well than to keep a large number of poor type cows and underfeed them. In any case it is better to have fewer cows well fed than a number poorly fed. A cow is often condemned as a low producer when insufficient feeding is the cause. Instances are on record that herds properly fed have yielded nearly twice as much as formerly, and the profit over feed cost increased 70 per cent. One case may be quoted where five cows under insufficient feeding conditions showed a profit of £57 8s. over cost of feed. When these same cows were fed properly they showed a profit of £105 over cost of feed.

Pregnant dry cows and heifers and growing heifers require a fair amount of protein in their feed. Ordinary rough bush feed is practically always deficient in protein. Too often dairymen let such stock fend for themselves on country carrying insufficient and unsuitable feed.

Balancing of Feed.

The food or foods should be of such a character as to provide in the right proportion the required amount of protein and carbo-hydrates. If cows are fed with foods which contain an unbalanced quantity of one or the other, it is so much waste. Speaking on general lines, the following well-known feeds are classed as proteins:—Clovers, lucerne, peas, vetches, trefoils, soy beans, bran, pollard, linseed, cotton seed, pea and bean meals. The following are classed as carbo-hydrates:—Grasses, maize, sorghums, sudan grass, elephant grass, maize meal. Fairly well balanced feeds—oaten hay, crushed oats. A balanced ration is one that contains these two principal ingredients in the proportion of 1lb. of digestible protein to 6lbs. of digestible carbo-hydrates. We might liken the protein to meat and the carbo-hydrates to bread.

A perusal of the analyses of the various feeds enables us to portion out the amount required of the various feeds in order that they balance at the rate of one to six. If a milking cow is fed with feeds containing a ratio

of 1 part protein to 10 parts carbo-hydrates, it may mean she eats 66 per cent. more of the carbo-hydrates than is necessary to obtain enough protein. Again, if a cow receives a food which is balanced at the rate of 1lb. of protein to 3lbs. of carbo-hydrates, she eats twice as much protein to obtain a sufficiency of carbo-hydrates. Apart from this being a wasteful practice, it is often impossible for the cow to digest the additional amount required of one or the other, and the consequence is her production suffers. Again, a lot of cows are not given enough of either food; they are practically starved, and, with a cow that is bred to produce, she impairs her constitution by endeavouring to keep up her milk flow, sapping her own body until she cannot do so any longer, with the result that her milk drops to zero—is deficient in its normal constituents, and her body is reduced to a frame of weakness.

The writer has frequently come across cows that were starved for protein in their feed. A matter of about three months ago a number of dairymen at Harvey were in difficulties owing to supplying milk deficient in "solids-not-fat" (the fat was well above standard), and, on the writer investigating the matter, it was found that the cows were being starved for "protein" in the feed they were receiving. With this aspect of feeding remedied the milk again assumed the required standard.

Lucerne. The "Queen" of Fodder Crops. Saves Bran and Pollard.
(Photo. from "Australian Farming.")

The remedy is lucerne, clovers, peas, vetches, bran, pollard, and cotton seed. On the other hand, cows often have been seen practically starving where there has been an abundance of clover, but little carbo-hydrates, such as grasses. It will be noticed that if a herd of cows is kept entirely on a crop of subterranean clover or red clover they will forage around the edge of the paddock and eat bracken, rushes, and scrub to endeavour to "balance" their feed—looking for bread to eat with the meat, and will often become miserable

and thin with digestion impaired—"starving in plenty." It may be likened to all meat and no bread. We can imagine how heartily sick we would become if we could get nothing but meat and just scraps of bread; again, if we could get only bread and no meat, we feel an abhorrence for bread. The same applies to the cow if her food is all protein and no carbo-hydrates, or all carbo-hydrates and no protein. To feed accurately, we must balance these two principal ingredients in feeds to an approximate ratio of one to six, according to the weight of the cow, which bears on her daily maintenance ration and the quantity and quality of the milk given. So, a cow weighing 1,000lbs. requires more feed for her daily maintenance than one weighing 800lbs. Again, a cow giving four gallons of milk per day requires more feed than one giving only two gallons; and a cow giving three gallons of five per cent. milk requires more feed than a cow giving three gallons of three per cent. milk. To find the point where the right amount of feed is required, we must have the cow under observation and test in order to be able to ascertain whether she responds in production to any increase of one or the other of the principal ingredients, or both, and also to be able to determine whether it pays to increase the feed. It may, however, be taken as a general rule that while a cow increases in her production, it pays to increase her feed.

The balancing of rations accurately requires care and some calculation, but, if the farmer will work on general lines remembering which foods contain protein and which contain carbo-hydrates, and mix them in an approximate proportion, he will greatly benefit as against the slap-dash method of not considering this aspect. As illustrating the necessity of balancing rations one result may be quoted of a herd of 30 cows which was divided into two lots of 15 cows, "A" and "B," each lot giving a similar quantity of milk daily. The two lots were fed on a balanced ration for a month prior to the test and yielded a constant daily quantity of milk. Lot "A" was continued on the ration (balanced). Lot "B" was fed on a ration (unbalanced) for fourteen days. At the end of the period lot "B" was giving an average of 8lbs. milk per day less than lot "A." For the next fourteen days the lots were reversed—lot "B" fed on the balanced ration; lot "A" fed on the unbalanced ration. At the end of this period lot "B" resumed the maximum yield, and lot "A" fell back 7lbs. per cow per day. The costs of the two rations, "balanced" and "unbalanced," were similar.

It may be taken as a general guide that an ample daily balanced ration for a cow weighing 800lbs. and giving 30lbs. of four per cent. milk per day is as follows:—2 to 2¼lbs. of digestible protein and 14 to 16 lbs. of digestible carbo-hydrates, of which the latter should contain ½lb. fat—the whole of these food ingredients contained in a ration that does not exceed 30lbs. of dry matter. It will be understood that the whole of any food does not represent digestible matter, and, in this respect, various feeds differ enormously. For instance, bran is rich and straw is poor in digestible food: saw-dust contains food, but a greater amount of energy is required in extracting its value as food than is supplied by the food it contains. I am quoting this as an example for farmers to remember when they turn their stock out into the bush where there is practically no good quality digestible feed and, generally, a negligible amount of protein feed. This is a great mistake with cows "in calf," and growing or pregnant heifers. Cows carrying calves, and growing and especially pregnant heifers require feeds which contain protein

to allow the normal growth of the feotus without drawing on the animals' system, and lowering their vitality prior to entering into the profitable stage, namely, when they freshen, resulting in two or three months of feeding to build up their systems before they can produce their maximum yield of milk and fat.

Remember always that permanent mixed pasture represents practically a balanced ration, and, provided there is full and plenty of pasture which contains a proportion of grasses and clovers, no additional feed is required.

Subterranean Clover. A Proved "Crop" Clover in W.A. to build up soil fertility and save bran. At Mr. Ecclestone's Farm, Boyanup, W.A.

It must not be taken for granted that pasture is always sufficient for a herd of dairy cows. Provision must be made to supplement pastures during portions of the year when growth is dormant or short, due to cold and wet, drought and heat.

Succulency and Palatability of Feed.

It is most important that the producing dairy cow be given feeds which are succulent and palatable. Cow's milk contains 87 per cent. of water, and, to yield large quantities of milk her food must be of a succulent nature to induce secretion to its maximum. Mixed pasture is ideal in this respect as it contains from 60 per cent. to 90 per cent. of moisture according to its stage of growth and seasonable conditions. Green—maize, sorghums, sudan grass, elephant grass, oats, barley, rye, vetches, lucerne, clovers, and such foods are excellent to supplement dormant or drying pastures to keep up succulency. To induce a cow to eat to her full capacity, her food must be palatable, and variability provides greater palatability. If a cow's food is of only one or two or even three varieties of foods, she does not usually eat

with a relish; she eats only to satisfy her hunger and body maintenance, but, with variability, she is induced to relish the feed and create the incentive to produce increased quantities of milk.

The town dairyman is at a disadvantage compared with the country farmer. The former must buy the majority of the feed required for his cows, and, for economy, concentrated feeds such as bran and chaff are largely used; but, where a suburban dairyman can grow maize he does so to the utmost the limited amount of land he usually has is capable of growing. As an instance, one dairyman in Belmont grows maize on about 10 acres of swamp land, cutting three crops during the year, and actually has green succulent feed from September to May; he wisely conserves the whole of his farmyard manure for the 10 acres. Brewers' grains are invaluable to supply succulency and palatability, and are eagerly sought after by the town dairyman. The country dairy farmer, however, is in a much more fortunate position inasmuch as he can grow practically all the feed his herd requires. The town

Field Peas. A valuable crop to save bran and pollard. Of great value to pasture Pigs.

dairyman can afford to buy feed on account of the much higher price he receives for the product of his herd, but it is not so with the country dairyman. The bran, pollard, chaff, and brewers' grains must be replaced by lucerne, clovers, peas, vetches, maize, sorghums, elephant grass, sudan grass, and mixed permanent pastures grown on his farm, and thereby provide economical, succulent, and palatable feed for his herd.

Economical Feeding.

In dealing with the need for succulent and palatable feeds, we have run on into the aspect of economy of feeding. This point is, without doubt, the most important in feeding dairy cows. It does not matter how much a

cow produces if it is not profitable. The dairy farmer has this matter entirely in his hands by growing such feeds to provide a full and complete ration. He has a wide range of crops to decide upon during all seasons of the year and the varying climates and rainfall, and, most important of all, he can grow feeds and avoid the labour of hand-feeding during the greater part of the year in most dairying districts. Let the cow cut her own feed, but provide for it by sowing the crops most suitable. Always remember that permanent mixed pasture represents the maximum of value at the minimum of trouble—it is the acme of successful and profitable dairying. Every year a farmer should lay down an additional area with permanent pasture, as pasture is his greatest asset, and, if he has sufficient area, the question of growing crops to supplement pastures is reduced to a minimum, and, most important, the purchase of high-priced feeds is practically eliminated.

The next most important feed to provide for cows is lucerne—it is called the queen of fodder crops. No crop can displace its great value on a dairy farm; it is the dairyman's bran. Lucerne is not easy to establish, but it is worth all the trouble required to get a stand. We are more and more convinced that it may be grown almost anywhere within reason, and the majority

Maize. The "King" of Fodder Crops. This crop was grown last year on reclaimed "Bottlebrush" land near Albany at Mr. Davey's Farm, and yielded over 23 tons per acre.

of cases of reported failures are the result of bad farming methods, not preparing the seed bed properly by cultivation and ridding of weeds. It is worth two years' preparation of the land to secure a good permanent stand of lucerne. The land must be prepared to a good tilth and free from weeds, and will generally be benefited for lucerne by being limed and inoculated.

Maize is the next most important crop. It is called the king of fodder crops and supplies the foil to lucerne, lucerne being rich in protein and maize abundant in carbo-hydrates. Maize requires fair to good summer land, good cultural methods, and frequent cultivation during growth.

Oats and barley form excellent winter fodder crops, and, for cows, they should be sown with peas or vetches, the peas and vetches supplying the protein (the meat), and the oats and barley supplying the carbo-hydrates (the bread).

On drier lands for summer crops, sorghums and sudan grass are most suitable, the latter being especially good under low rainfall conditions. Elephant grass is a splendid yielder of excellent feed for cows, and may be grown on inaccessible parts of the farm where ploughing and cultivation is difficult owing to irregularity of the land, such as creek banks and awkward corners of paddocks, etc.

Permanent Pasture at Peel Estate Group Settlement, W.A.
Paspalum and Subterranean Clover.

Permanent Mixed Pasture.

The writer strongly advocates a combination of grasses and clovers for permanent pasture in order that we have a balanced ration and growth during different periods. The grasses recommended are—Paspalum dilatatum, Rhodes, Cocksfoot, Italian rye, Kiluyu and Prairie grasses. Clovers—Subterranean, White Dutch, and Red clover. In the warm districts—Paspalum dilatatum, and Rhodes grass, Subterranean clover, and White Dutch clover: in the cooler districts, the addition of Cocksfoot, Rye, and Prairie grasses, and Red clovers, reducing the other grasses and clovers.

The amount of seed required for general sowing is—Paspalum dilatatum, 8 to 10lbs.; Rhodes grass, 2lbs.; White Dutch clover, 1 to 2lbs.; Subterranean clover, 1 to 2 lbs. per acre. As in the case of the preparation of land for crops, the land should be brought to a good tilth, and be free from weeds, and particularly should it be rolled prior to seeding to form a firm seed bed.

Conservation of Roughage—Hay and Silage.

It is good farming to conserve fodder for bad seasons, no matter how good the farm is or how excellent the climate and rainfall. In any case there is an abundance at periods of the year and shortage at other stages.

Oaten, wheaten, sudan, lucerne, and clover hay are excellent roughages for dairy cows and are cheaply stored, and, if mixed, supply a balanced feed to supplement other feed available. The clover hay is particularly valuable in the late summer (when the pastures are bare of clovers) to feed in addition to green maize, sorghums, sudan grass, and, with a supply of lucerne, the necessity of purchasing such expensive feeds as bran and chaff is practically eliminated.

Oats. This crop was cut for hay at Group No. 3, near Cape Leeuwin, from land which was virgin country 18 months previously.

Ensilage, undoubtedly, forms the greatest asset a dairyman can have, as it is the nearest approach to permanent pasture at a time when pastures are scarce, and is the cheapest roughage for cows. In the writer's opinion, a silo is just as much part of the equipment of a good-sized dairy farm as are the dairy, bails, yards, and barn. Large quantities of succulent feed can be stored alongside the mangers easy to get, and free from destruction by pests, vermin, and fire. The reduction in feeding costs is enormous and makes dairying possible and very profitable in districts that are good winter dairying country but poor summer dairying country. Excellent crops can be grown in the winter for storage and feed through the summer. 100 tons of oat and pea silage will provide an ample roughage ration daily for 40 cows for six months. The filling of the silo is the work of three or four days. The feeding of the herd from the silo alongside the bails is a matter of an hour's work daily under cover from wet, heat, and cold. Should all the silage not be used during one season it will remain in good condition, and the silo may either

be re-opened the next season or filled up again. Cows like silage and immediately respond by increased yields of milk when it is used to supplement drying or dormant pastures. All our herd testing results show the great economy of silage feeding as roughage.

We have made special efforts in giving the fullest information relative to the erection of silos and ensilage-making in *Bulletin* No. 75, and have had special "silo drives," with the result that great interest has been stimulated and a number of reinforced silos erected in different parts of the State, with great success. Mr. D. Malcolm, of Wagin, who has two silos in use over the second year, found it cost only 8s. 6d. per ton of silage, including all charges, to prepare the land, plant, cut, fill, and allow full depreciation and interest. Crop ensiled oats and peas.

Silos. The "Insurance" of profitable Live Stock Farming. Two 85 ton silos at Mr. A. W. Padbury's Guernsey Stud, Koojan. (Re-inforced concrete—cost £120 each complete.)

Feed according to Individual Production.

To obtain best and most economical results in dairy cow feeding, we must feed according to individual production. Dairy farmers can save the feed bill very materially by noting how each cow responds to its feed. It naturally follows that, in order to ascertain results with any degree of reliability, weighing, or measuring various concentrates or roughages fed daily to each cow, together with the weighing of the milk yielded night and morning, and testing for fat percentage, must be carried out. With a herd of, say, 20 cows, there are varying factors in the weight of the animals—period of lactation, quantity and quality of milk given, and the degree of efficiency of the animal, which bear on the quantity of feed that should be given. A well-nourished dairy cow uses about 47 per cent. of the food she consumes to support her body, 24 per cent. in the work of converting food into milk, and about 29 per cent. finally appears as milk. The live weight of the animal and the degree of efficiency of the cow from a "dairy breeding" point of view bear on the amount of feed required for body maintenance. "Breeding" is a big factor

in converting feed into milk; period of lactation and quantity and quality of milk must be considered in regard to individual feeding.

It will often be found that, by paying attention to these factors, a dairyman may save money in feeding and obtain equal or better yields from his herd. If a cow responds to liberal feeding, increase her feed if it pays—the weight of milk and Babcock test will be able to tell you. Other cows in the herd are using your feed money to build unwanted flesh and fat on their bodies, and you find you are losing 2d. to 4d. per day with some cows through over-feeding, and even greater amounts through under-feeding other cows.

Maize and Lucerne. The "King" and "Queen" of Fodder Crops. Grown at Brunswick, W.A. The crop of Maize on the right yielded 18 tons 12cwt. of green fodder per acre in 13 weeks 3 days.

The "Famous Five" Fodders of Financial Feeding.

Permanent pasture, maize, lucerne, clover hay, and ensilage are the "famous five" fodders that represent financial success to the farmer in feeding dairy cows. These feeds may all be grown and conserved on the farm. Dairy farmers who make provision for these fodders provide suitable "balancing" feeds for all periods of the year, and are insured against fires, floods, and droughts. As the "ace," "king," "queen," "jack," and "joker" are the leading cards in the playing pack, so permanent pasture (the ace), maize (the king), lucerne (the queen), clover hay (the jack), and ensilage (the joker) are the top cards in the serious matter of economical feeding of dairy cows.

(To be continued.)

HERD TESTING.

WESTERN AUSTRALIAN OFFICIAL RESULTS FROM 1ST JULY, 1923, TO 30TH JUNE, 1924.

Conducted by Officers of Dairy Branch.

Name of Cow.	Owner.	Breed.	Herd Book No.	Age.		Date of Calving.	No. of Days in Test.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Weight of Milk Last day of Test.	Remarks.
				Yrs.	Mths.			lbs.	%	lbs.	lbs.	
MATURE COWS—STANDARD REQUIRED 350 LBS. OF BUTTER FAT—273 DAYS.												
Carnation of Dardanup ...	R. H. Rose ...	Jersey ...	9995	5	11	9-8-23	273	10,788	5·57	600·99	29	
Mokine Lady Guildford III. ...	T. H. Wilding ...	do. ...	10634	10	0	1-10-23	273	9,265	6·25	579·23	24½	
Brightlass of Wollingury ...	D. J. Goyder ...	do. ...	6818	5	9	31-1-23	273	11,289	4·93	556·74	28	
Daisy 6th of Melrose	W. Padbury ...	do. ...	4512	11	7	16-5-23	273	10,605	5·18	550·05	33	
Maranora of Telleraga	R. H. Rose ...	do. ...	6707	6	2	23-5-23	273	10,533	5·05	531·90	27	
Fondant 3rd of Garden Hill ...	W. Padbury ...	do. ...	7224	11	1	19-10-22	273	9,037	5·52	499·64	27½	
Yarraview Bonnie Annie ...	A. W. Padbury ...	Guernsey...	564	5	10	7-6-23	273	8,127	6·11	496·63	22	
Lily II. of Dardanup	R. H. Rose ...	Jersey ...	8946	5	10	27-8-23	273	9,345	5·24	489·90	25½	
Jessie of Dardanup	do.	do. ...	8945	5	10	31-7-23	273	9,320	5·14	479·25	19	
Retford Buttercup II.	D. J. Goyder ...	do. ...	6830	6	5	18-7-23	273	6,535	6·87	449·52	15	
Morden Lady V. of Waterville ...	A. W. Padbury ...	Guernsey...	130	10	5	24-3-23	273	10,290	4·24	437·21	34	
Daisy of Grass Vale	R. H. Rose ...	Jersey ...	8473	6	11	3-8-23	273	7,615	5·56	423·83	17	
Fancy of Ventonia	T. L. Rose ...	do. ...	8648	7	11	7-4-23	273	7,782	5·35	416·78	18	
Mokine Dianthus	Walker & Co. ...	do. ...	8483	6	2	4-8-23	273	7,153	5·73	410·34	20	
Beauty 3rds Wangara of Pine Hill	R. H. Rose ...	do. ...	6134	6	10	14-8-23	273	9,214	4·44	409·54	26	
Veronica of Tarnpirr	D. J. Goyder ...	do. ...	5174	7	8	27-5-23	273	8,121	4·87	395·70	9	
Madge of Dalebank	D. Malcolm ...	do. ...	4759	10	3	4-8-23	273	6,985	5·59	390·44	17	
Lily II. of Dardanup	R. H. Rose ...	do. ...	8946	5	0	10-10-22	273	7,933	4·92	390·16	18½	
Fancy of Liryclea	A. H. Henning ...	do. ...	6674	5	10	1-8-23	273	7,582	5·10	387·19	21	
Romany Maid of Tarnpirr ...	R. Rose ...	do. ...	6036	6	2	5-8-23	273	6,823	5·66	386·24	14	
Silver Bell of Roelands ...	A. H. Henning ...	do. ...	10047	5	6	24-8-23	273	7,911	4·82	386·01	20	
Obligato	D. J. Goyder ...	do. ...	4964	8	2	21-7-23	273	7,641	4·99	381·58	16	
Retford Violet	W. Padbury ...	do. ...	6938	5	5	9-3-23	273	6,528	5·78	378·08	15	
Rhodesia of Ventonia	T. L. Rose ...	do. ...	8469	5	0	26-8-23	273	6,884	5·33	366·86	14½	
Lady of Inglewood	D. Malcolm ...	do. ...	5910	7	0	26-9-23	243	6,111	5·89	360·11	8½	
Fondant 9th of Garden Hill ...	W. Padbury ...	do. ...	8456	6	0	15-9-23	273	6,801	5·23	355·84	16	
Overton Mary	W. G. Burgess ...	Ayrshire ...	2601	12	11	10-2-23	273	7,994	4·38	350·51	15½	
Mokine Columbine	T. H. Wilding ...	Jersey ...	10043	6	0	10-10-23	273	5,881	5·94	349·85	13½	
Rhodesia 5th of Penryn ...	T. L. Rose ...	do. ...	8470	6	11	18-7-23	273	7,272	4·77	347·35	11	
Winifred of Oakbank	W. G. Burgess ...	Ayrshire ...	6167	6	10	29-6-23	273	8,475	4·02	341·07	8½	
Lux of Yarralla	D. J. Goyder ...	Jersey ...	6825	6	0	21-8-23	273	7,143	4·66	333·50	15½	
Lady Betty II. of Koogan ...	A. W. Padbury ...	Guernsey...	872	5	7	13-6-23	273	7,685	4·33	332·99	18½	
Lady of Inglewood	D. Malcolm ...	Jersey ...	5910	6	2	12-11-22	273	5,898	5·62	331·46	5	
Dorinda 4th of Dardanup ...	P. Rose	do. ...	9993	6	7	1-4-23	273	5,715	5·50	314·38	17	
Creamy of Dardanup	R. H. Rose ...	do. ...	8941	5	0	25-10-22	273	6,197	4·99	309·44	16	
Yarraview Isabel	A. W. Padbury ...	Guernsey...	397	6	0	11-6-23	273	6,238	4·77	297·86	19	

Lady Fowler II. of Dardanup ...	R. H. Rose ...	Jersey ...	10003	7	0	7-11-22	273	6,252	4·65	290·63	17½	
Antimony's Elvira	T. L. Rose ...	do. ...	8465	10	8	13-4-23	273	5,142	5·61	288·67	6½	
Mokine Picotee	Walker & Co. ...	do. ...	8486	6	3	10-8-23	243	5,135	5·61	288·55	5	
Jesslemia XI. of King's Vale ...	D. Malcolm ...	do. ...	6339	5	11	29-6-23	273	6,510	4·36	284·14	10½	
Purity of Gowrie Park ...	W. G. Burgess ...	Ayrshire ...	4915	6	3	5-10-23	213	6,463	4·25	274·95	11	
Golden Gem of Dardanup ...	D. J. Goyder ...	Jersey ...	9988	5	11	30-9-23	273	6,120	4·39	267·94	7½	
Belverdere 5th of Dardanup ...	P. Rose	do. ...	8925	7	10	21-8-23	213	5,797	4·59	266·31	10	
Marge of Oakbank	W. G. Burgess ...	Ayrshire ...	6161	6	10	8-6-23	243	6,043	4·41	266·52	4½	
Quality of Oakbank	do. ...	do. ...	6163	6	8	16-6-23	273	7,042	3·70	260·87	12½	
Golden Bell of Roelands ...	A. H. Henning ...	Jersey ...	10117	6	5	5-8-23	153	3,538	5·73	202·99	20½	Sold.
Blossom II. of Merridale ...	P. Rose	do. ...	8927	5	2	7-12-23	153	2,862	5·13	146·87	11	Withdrawn.
Lady of Moorlands	P. Rose	do. ...	8938	5	4	1-1-24	120	2,670	5·01	133·92	19	do.
Agree of Oakbank	W. G. Burgess ...	Ayreshire...	6158	7	7	17-4-24	60	1,755	5·01	88·08	27	do.
Carlotta of Ventonia	T. L. Rose ...	Jersey ...	8467	10	3	30-10-23	33	1,221	4·28	52·34	37	do.
Dorinda IV. of Dardanup ...	P. Rose	do. ...	9993	7	6	9-3-24	30	915	4·82	44·16	30½	do.

SENIOR 4 YEARS OLD (OVER 4½ YEARS AND UNDER 5 YEARS)—STANDARD 325 LBS. OF BUTTER FAT.

Lady Fowler 9th of Dardanup ...	T. L. Rose ...	Jersey ...	10008	4	9	30-6-23	273	9 838	4·98	489·95	20	
Flavoria of Banyule	Dept. of Agriculture	do. ...	8489	4	11	19-3-23	273	7,908	5·92	468·55	19	
Girlie of Sarnia	D. Malcolm ...	do. ...	9992	4	8	20-7-23	273	9,180	4·85	446·01	23	
Fairy of Dardanup	R. H. Rose ...	do. ...	8942	4	11	10-12-22	273	8,305	4·75	395·05	27½	
Lydia 5th of Yarralla	D. J. Goyder ...	do. ...	6826	4	11	28-6-23	273	7,044	5·08	357·77	15	
Milton's Rosebud	A. W. Padbury ...	Guernsey...	500	4	9	17-9-23	273	7,255	4·72	342·89	15	
Ice Cream of Glen Iris ...	W. Padbury ...	Jersey ...	7110	...		30-9-23	273	5,978	5·00	299·32	12½	
Myrtle of Merridale	P. Rose	do. ...	8928	4	8	15-6-23	243	4,828	5·44	262·85	11½	
Milkmaid 1st of Blackheath ...	H. O. Timms ...	M.S. ...	10091	4	11	17-6-23	243	6,428	3·84	247·25	8½	
Retford Tessie	W. Padbury ...	Jersey ...	8464	4	6	10-10-23	183	2,952	5·53	163·28	9	

JUNIOR 4 YEARS OLD (OVER 4 YEARS AND UNDER 4½ YEARS)—STANDARD 300 LBS. OF BUTTER FAT.

Mokine Woodbine	T. H. Wilding ...	Jersey ...	8487	4	1	4-10-23	723	6,277	5·95	373·76	15	
Tipperary Mona	W. G. Burgess ...	Ayrshire ...	6165	4	3	14-6-23	273	6,568	4·88	320·58	10	
Twylish Madeira of Roelands ...	D. Malcolm ...	Jersey ...	6832	4	1	5-8-23	273	5,356	5·77	309·08	10½	
Tipperary Winsome	W. G. Burgess ...	Ayreshire...	6166	4	3	21-9-23	243	6,441	4·67	301·42	6	
Lady of Moorlands	P. Rose	Jersey ...	8938	4	4	1-1-23	273	4,644	4·74	220·14	11½	
Prune II. of Gleneira	W. G. Burgess ...	Ayreshire...	8518	4	1	4-12-23	183	3,183	4·10	130·54	8½	Withdrawn.
Tiny of Grass Vale	R. H. Rose ...	Jersey ...	...	4	2	25-7-23	63	2,392	5·33	127·56	38½	Sold

SENIOR 3 YEARS OLD (OVER 3½ YEARS AND UNDER 4 YEARS)—STANDARD 275 LBS. OF BUTTER FAT—273 DAYS.

Boronia of Grass Vale	R. H. Rose ...	Jersey ...	9994	3	11	15-8-23	273	8,091	5·06	410·11	26	
Favourite of Roelands	D. J. Goyder ...	do. ...	6819	3	9	17-3-23	273	7,697	5·02	396·37	22½	
Mokine Lady Noble	Walker & Co. ...	do. ...	10633	3	7	12-8-23	273	6,190	5·88	364·27	16	
Gladys of Roelands	D. J. Goyder ...	do. ...	6821	3	7	10-5-23	273	5,763	5·33	318·93	10	
Mokine Fancy	T. H. Wilding ...	do. ...	8484	3	8	7-10-23	213	5,337	5·99	319·13	12	
Yarraview Georgina	A. W. Padbury ...	Guernsey...	782	3	7	28-5-23	273	5,763	5·24	297·04	14	
Rena II. of Gleneira	W. G. Burges ...	Ayrshire ...	8519	3	11	14-8-23	273	5,653	5·09	288·13	6½	
Pride of Moorlands	P. Rose	Jersey ...	8940	3	10	20-6-23	123	1,899	5·78	109·00	12	Withdrawn.
Mamselle Mimi of Hamel Lea...	A. H. Henning ...	do. ...	10046	3	7	24-10-23	63	1,765	5·16	91·12	27½	Sold.
Lass of Moorlands	P. Rose	do. ...	8939	3	9	29-3-24	30	645	4·38	28·26	21½	Withdrawn.

HERD TESTING: Official Results since 1st July, 1923—continued.

Name of Cow.	Owner.	Breed.	Herd Book No.	Age.		Date of Calving.	No. of Days in Test.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Weight of Milk Last day of Test.	Remarks.
				Yrs.	Mths.			lbs.	%	lbs.	lbs.	
JUNIOR 3 YEARS OLD (OVER 3 YEARS AND UNDER 3½ YEARS)—STANDARD 250 LBS. OF BUTTER FAT.												
Mokine Malmaison	Walker & Co. ...	Jersey ...	11724	3	1	10–9–23	273	5,985	6·92	414·70	15½	
Rhodora II. of Dalebank ...	D. Malcolm ...	do. ...	8451	3	1	4–9–23	273	6,286	5·79	364·01	14½	
Daisy of Garden Hill	W. Padbury ...	do. ...	1628	3	3	16–6–23	273	5,785	6·18	357·95	14½	
Boronia of Grass Vale	R. H. Rose ...	do. ...	9994	3	2	9–10–22	273	6,675	4·94	330·07	20	
Lass of Moorlands	P. Rose	do. ...	8939	3	0	4–6–23	243	4,917	5·44	284·81	9	
Wisteria II. of Homeleigh ...	D. Malcolm ...	M.S. ...	N.Y.A.	3	5	19–5–23	273	6,184	3·94	243·85	9	
Modest II. of Homeleigh ...	do.	do. ...	N.Y.A.	3	1	12–2–23	183	3,426	3·49	119·69	14½	
Blossom of Moorlands	P. Rose	Jersey ...	8926	3	3	31–1–24	60	1,440	5·84	84·00	23	Withdrawn.
SENIOR HEIFERS (OVER 2½ YEARS AND UNDER 3 YEARS)—STANDARD 225 LBS. OF BUTTER FAT—273 DAYS.												
Jean II. of Grass Vale ...	R. H. Rose ...	Jersey ...	9996	2	9	23–5–23	273	8,701	5·81	508·93	31	
May of Blackheath	Wooroloo Sanatorium	M.S. ...	N.Y.A.	2	7	23–6–23	273	10,065	3·84	386·56	30½	
Mokine Empire's Lily V. ...	T. H. Wilding ...	Jersey ...	10635	2	10	20–6–23	273	5,725	6·67	382·09	18	
Mokine Empire's Lily VI. ...	do.	do. ...	10636	2	8	6–5–23	273	6,120	6·21	380·59	20½	
Fuchsia III. of Gleneira ...	W. G. Burgess ...	Ayrshire ...	8514	2	10	15–6–23	273	6,813	4·52	307·89	11	
Annetta 3rd of Wollongbar ...	W.A. Government...	Guernsey...	589	2	8	2–9–23	273	4,963	1·05	300·39	14	
Mamselle Mimi of Hamel Lea ...	A. H. Henning ...	Jersey ...	10046	2	9	23–12–22	273	5,166	5·37	277·85	10½	
Gem of Moorlands	P. Rose	do. ...	8937	2	11	9–7–23	273	5,161	4·86	251·17	9	
Dairymaid 6th of Gleneira ...	W. G. Burgess ...	Ayrshire ...	8513	2	11	28–7–23	273	5,770	4·12	238·05	11	
Virginia of Nundorah	A. W. Padbury ...	Guernsey...	778	2	7	29–5–23	273	3,941	5·34	210·56	13	
Thelma of Blackheath	H. O. Timms ...	M.S. ...	12847	2	7	29–3–23	243	5,063	4·03	204·50	5	
Myrtle of Moorlands	P. Rose	Jersey ...	8929	2	8	30–6–23	93	1,978	5·10	100·95	16½	Withdrawn.
JUNIOR HEIFERS (UNDER 2½ YEARS—STANDARD 200 LBS. OF BUTTER FAT—273 DAYS.												
Lady Fowler 14th of Dardanup	R. H. Rose ...	Jersey ...	12093	1	11	30–8–23	273	7,220	5·38	388·37	26½	
Lily of Grass Vale	do.	do. ...	8947	2	5	2–2–23	273	7,482	5·00	374·63	30½	
Lady Fowler 12th of Dardanup	do	do. ...	10011	2	4	24–3–23	273	6,970	4·75	332·25	24½	
Lady Fowler 17th of Dardanup	do.	do. ...	11695	1	11	17–8–23	273	5,766	5·75	331·64	20	
Lady Fowler 13th of Dardanup	D. Malcolm ...	do. ...	8986	2	4	26–6–23	273	7,036	4·43	312·15	15	
Girlie II. of Sarnia	do.	do. ...	11633	2	0	14–1–23	273	7,140	4·13	295·36	23	
Dunalister Manakin's Peree's Capture II.	R. H. Rose ...	do. ...	10392	1	11	1–8–23	273	4,730	5·99	283·76	15½	
Milton's Daisy II.	A. W. Padbury ...	Guernsey...	922	1	8	31–3–23	273	5,515	5·47	278·37	20½	
Pet VIII. of Gleneira	D. Malcolm ...	M.S. ...	N.Y.A.	1	9	28–2–23	273	5,802	4·67	270·98	18½	
Alice of Blackheath	Wooroloo Sanatorium	do. ...	N.Y.A.	2	5	15–7–23	273	6,616	4·29	264·66	16½	
Picton's Trequean Flirt ...	A. W. Padbury ...	Guernsey...	747	2	1	15–4–23	273	5,566	4·74	264·20	22½	
Pride of Blackheath	Wooroloo Sanatorium	M.S. ...	N.Y.A.	2	1	6–4–23	273	7,049	3·73	263·52	21	
Lady Fowler 18th of Dardanup	T. L. Rose ...	Jersey ...	12830	1	10	28–7–23	243	4,650	5·58	259·90	17	
Mokine Noble Lily	Walker & Co. ...	do. ...	11795	1	7	16–6–23	273	4,872	4·99	243·22	13	

Blossom of Moorlands	P. Rose	do. ...	8926	2	5	1-3-23	273	4,476	5·27	236·20	14½		
Beauty of Sarnia	D. Malcolm ...	do. ...	12086	1	9	27 5 23	273	3,860	5·91	228·29	11		
Fancy's Pride of Ventonia ...	T. L. Rose ..	do. ..	12829	1	8	18 7 23	243	4,417	5·03	223·47	13		
Lily of Roelands	D. J. Goyder ..	do. .	10619	2	3	9-11-22	273	4,881	4·43	216·64	11		
Jessimia of Sarnia	D. Malcolm ...	do. ...	12088	1	11	3 8-23	273	4,293	4·67	200·64	10		
Banker II. of Moorlands ...	P. Rose	do. ...	N.Y.A.	1	10	13 8-23	213	3,253	4·98	162·28	10	Withdrawn.	
Honey of Blackheath	H. O. Timms ..	M.S. ...	11766	2	5	7 4-23	243	4,428	3·60	159·78	5		
Maid of Moorlands	P. Rose	Jersey ...	N.Y.A.	1	7	15-8-23	213	3,129	4·84	151·67	5½		
Tipperary Wendy	W. G. Burgess ...	Ayrshire ...	8520	2	0	1-8-23	63	1,449	4·90	57·17	13	Withdrawn.	

365 DAYS TEST.

Jean II. of Grass Valley ...	R. H. Rose ...	Jersey ...	9996	2	9	23-5-23	365	11,181	6·04	676·22	24		
May of Blackheath	Wooroloo Sanatorium	M.S. ...	N.Y.A.	2	7	23 6-23	365	12,146	4·04	490·56	19		

OFFICIAL HERD TESTING—YEAR ENDING 30th JUNE, 1924.

The outstanding performances for the year, which are of exceptional merit, are as follow:—

Jersey cow "Carnation of Dardanup," owned by Mr. R. H. Rose, Burekup, produced 10,788lbs. milk, 600.99lbs. butter fat in 273 days.

Jersey heifer "Jean II. of Grass Vale," owned by Mr. R. H. Rose, Burekup, at 2 years 9 months produced 11,181lbs. milk, 676.22lbs. butter fat in 365 days.

Milking Shorthorn heifer "May of Blackheath," owned by the West Australian Government (Wooroloo Sanatorium), at 2 years 7 months, produced 12,146lbs. milk, 490.56lbs. butter fat in 365 days.

It will be noted that the average production of all cows submitted to the test, including failures, and with allowances for juniors, is the splendid one of 399.64lbs. butter fat.

A particularly pleasing feature is that the highest producers in the various classes were bred in Western Australia.

Appended is the result of the annual competition for prizes given jointly by the Royal Agricultural Society and the Department of Agriculture:—

BULL WITH THREE OR MORE DAUGHTERS (WEST AUSTRALIAN BRED) WITH PRODUCTION RECORD ABOVE STANDARD.

YEAR ENDING 30TH JUNE, 1924.

Name of Cow.	Owner.	Breed.	Herd Book No.	No. of Days in Test.	Total Butter Fat.
					lbs.
arnation's Masterpiece of Garden Hill, (2065)—					
Carnation of Dardanup ...	R. H. Rose	Jersey ...	9995	273	600·99
Lady Flower 9th of Dardanup	T. L. Rose	Jersey ...	10008	273	489·95
Lily II. of Dardanup ...	R. H. Rose	Jersey ...	8946	273	489·90
Jessie of Dardanup ...	R. H. Rose	Jersey ...	8945	273	479·25
Fairy of Dardanup ...	R. H. Rose	Jersey ...	8942	273	395·05
Creamy of Dardanup ...	R. H. Rose	Jersey ...	8941	273	309·44
					Average 460·76

WESTERN AUSTRALIAN GOVERNMENT OFFICIAL PURE-BREEDS HERD-TESTING SCHEME—YEAR ENDING 30TH JUNE, 1924.

Winning Cows in Annual Competition Prizes donated jointly by Royal Agricultural Society and the Department of Agriculture.

Name of Cow.	Owner.	Breed.	Herd Book No.	Age.	Date of Calving.	Number Days in Test.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Weight of Milk last day of Test.
				Yrs. Mths.			lbs.	%	lbs.	lbs.
Cows 4 Years and Over—										
Carnation of Dardanup ...	R. H. Rose, Burekup ...	Jersey ...	9995	5 11	9-8-23	273	10,788	5·57	600·99	29
Mokine Lady Guildford III.	T. H. Wilding, Mokine ...	Jersey ...	10634	9 0	1-10-23	273	9,265	6·25	579·33	24½
Brightlass of Wollingurry ...	D. J. Goyder, Roelands ...	Jersey	6818	5 9	31-1-23	273	11,289	4·93	556·74	28
Cows on 2nd Calf under 4 Years—										
Jean II. of Grass Vale ...	R. H. Rose, Burekup ...	Jersey ...	9996	2 9	23-5 23	273	8,701	5·81	508·93	31
Mokine Malmaison	Walker & Co., Spencer's Brook	Jersey ...	11724	3 1	10-9 23	273	5,985	6·92	414·70	15½
Boronia of Grass Vale ...	R. H. Rose, Burekup ...	Jersey ...	9994	3 1	15-8 23	273	8,091	5·06	410·11	26
Heifers—										
Lady Fowler 14th of Dardanup	R. H. Rose, Burekup ...	Jersey	12093	1 11	30-8 23	273	7,220	5·38	388·37	26½
May of Blackheath ...	Sanatorium Farm, Wooroloo	M. Shorthorn	N.Y.A.	2 7	23-6 23	273	10,065	3·84	386·56	30½
Mokine Empire's Lily V. ...	T. H. Wilding, Mokine ...	Jersey ...	10635	2 10	20 6-23	273	5,725	6·67	382·09	18

THE HOUSE AND THE GARDEN.

H. CAMPBELL,
Government Gardener, Perth.

In choosing a site for a dwelling place, or a home in the country, the question of garden and grass lawns should be taken into consideration. In the country there is no need to be squeezed into a small space of ground as is the case in towns. The grass lawn should be apart from the flower garden. It is undesirable that a homestead should be too near a public road. Where there is choice a knoll or piece of rising ground should be preferred to either a level or a hollow, and should there be any fine natural scenery in the neighbourhood, the house should be situated where the best or at any rate a good view of it could be obtained. The spot should not be commanded by neighbouring hills or other eminences unless the view could be shut out by plantations. The healthiness of the situation should be thoroughly investigated.

The shape or outline of the ground ought to have particular attention. A single form square or a parallelogram, not too narrow, is the most suitable, for ground of an irregular outline with angular corners is more expensive to fence and less capable of being properly laid out for either useful or ornamental purposes.

The climate of the situation might also be taken into account, for climates may vary to some extent in places not far apart, and if a situation can be found that is sheltered from a cold South-West or a hot Easterly wind, either by higher ground or forest, it would be decidedly more comfortable to live in and more beneficial to trees and shrubs or whatever plants might be cultivated.

However great may be the love of nature, natural scenes, and objects, landscape gardening should be distinctly regarded as a work of art. Its objects are comfort, convenience, use and even luxury, and it differs or should differ upon the whole from all natural scenes—a main object being to bring together and cultivate the most beautiful, useful, or novel vegetable productions from all parts of the world. Therefore, a garden must differ in all material qualities from anything existing in a state of nature.

Surface should be treated artistically, mounds or other rises being reduced to levels or slopes of irregular curvature, distinguishable either by their beauty of form or their clothing of herbage, which should be distinct from anything of the kind in the neighbourhood. Should indigenous trees be planted, they should not be gouped as though they had grown up naturally, but planted singly and allowed so much space to develop that they would be at once recognised as having come under the dominion of art. Therefore, a garden must differ in all material qualities from anything existing in a natural condition.

Utility and convenience should be considered even in matters of ornaments, for things useful may be also made ornamental if the proper course is pursued.

Economy should be well studied. A careful calculation should be made not only of the cost of the land and house, but also of the laying out and maintenance, and no unnecessary expense incurred.

Broad and unnecessary walks should be avoided, walks and roads being particularly expensive to make and keep in order.

LAYING OUT.

One of the greatest mistakes that can be made in the laying out of a garden is attempting too much, whereby the ground may be so frittered away and broken up in its general arrangement as to be deficient in character as well as in beauty, and it is a fault that might cost as much to alter as it did to carry out the design. A garden may likewise be apparently reduced in size by overcrowding with trees and shrubs, which contract the space and thus cause regret in the proprietor and a lowering of interest in the visitors. It is rarely that anyone ever thins out a shubbery either in time or to such an extent as it ought to be done. For a few years everything may seem correct, the shrubs thrive and fill the space allotted to them, and the whole may present a handsome and satisfactory appearance, but ere long overcrowding becomes apparent. Then a struggle for life begins which, if allowed to continue, results in dryness and deficiency of nutriment in the soil.

The most satisfactory plan to follow in the planting of shrubberies is to select shrubs that are certain not to attain too large a size, and after deciding on the most suitable mode of arrangement and grouping, etc., plant them at such distances apart as will admit when full-grown that each has a clear space around it. The intervals may then be filled with other and more rapidly growing sorts that are able to withstand severe pruning, and thus be kept within such bounds as will permit the full growth of the permanent subjects, and be finally removed.

The formation of groups or clumps of trees and shrubs affords a good opportunity for the display of taste, both in the outlines and in the disposition of subjects. The outlines should be distinguished by variety, graceful curves, flowing lines and irregularities, especially on the sides that are most seen. The groups should be of considerable breadth, otherwise they might be seen through, and a poor effect would be produced. The group, instead of being bold and proportionate, would appear as a mere strip, instead of a cluster or mass. Groups should also bear a sort of relationship to each other, by being arranged so as to form a varied but perfect whole, with here and there a tall tree standing alone.

AVENUE.

An avenue forms a fine feature in a place that is sufficiently large in extent, but it should never be adopted where it would be less than two hundred yards in length, and even that would be comparatively insignificant unless some good scenery, such as a wooded hill or some other pleasant piece of landscape, existed beyond that would cause it to appear longer than the reality. The breadth of the road should never be less than half a chain, and the trees suitable for our South-West climate where we get heavy rains.

Plane platanus, being deciduous trees, would be best adapted to a wet locality, thus admitting the sun in the winter months to dry up the road. Where the water soaks quickly through and a darker shade of tree preferred,

the *Pinus insignis* would be suitable if preferred. The Carob tree, otherwise Locust tree of scripture, St. John's Bread, would be a profitable tree to plant in the wheat belt.

The ground should the thoroughly opened up for at least three feet each way and a little stable manure added to keep the ground open, and after planting the young trees should be given a little water every two weeks until they become established. If this were done success might follow. At the Chapman Experimental Farm it is stated that the ordinary pepper tree (*Schinus molle*) is doing fairly well. If doing well there it should do well anywhere in the wheat belt. The Kurrajong tree (*Papulneum*) should be highly satisfactory in hot dry districts.

BRITISH EMPIRE EXHIBITION.

Western Australia's Exhibits.

In the June issue of the *Journal*, at page 124, it was stated:—

> "The fruit-growing industry is particularly well represented. The Fruit-growers' Association rendered enthusiastic assistance in collecting an exhibit that would do credit to the State, and, in addition to a choice collection of the best export varieties of apples grown in the Bridgetown and Mount Barker districts, which went forward in time for the opening of the Exhibition, a monthly supply was forwarded by the Association during March, April, and May to renew the exhibit from time to time."

The statement made above is scarcely in accordance with the facts, as the credit for collecting and forwarding the exhibits was due to the State Fruit Advisory Board.

CLASSING THE FARMER'S CLIP.

H. McCallum,
Sheep and Wool Inspector.

When wool prices are high some growers begin to imagine that the clip can be "bundled up" and sent to market in any fashion. Experienced men know that, even at extreme prices, careful preparation will always more than pay for itself. Now that the shearing season is about to start, the preparation of the clip becomes of the greatest importance. Growers should study the methods pursued by buyers when selecting and appraising the lots for which they will bid. To obtain the best results wool should be baled in such a manner as to give the buyer an opportunity of arriving at its true quality, and convey to him a feeling of confidence in the lot that is before him for sale.

All buyers do not require the same class of wool. Some manufacturers specialise in fleece wools only, some in pieces and bellies, others in locks and lambs, and so on. It follows, therefore, from the grower's point of view, as well as from that of the buyer, that far more satisfactory business is done when each description or type is kept separate as far as practicable. If, on the other hand, everything is thrown into a bale, regardless of quality, the buyer has to average the value of same, and it is certain he will err in his own favour.

Wool is bought on what is known as a clean scoured basis, and sold in a greasy state at so much per pound. When examining the wool for sale, the buyer first of all selects the quality of wool which suits his purpose; he then proceeds to estimate the percentage of clean wool he will get out of this particular lot before him. On these important factors really depends the success of the buyer, and of course this art is only acquired by years of practical experience. The importance of these two determinations may be shown in this way. The buyer, having selected a lot which suits requirements, estimates that the yield of this wool on a clean scoured basis is 50 per cent. (half weight). Assuming that the clean market price he can pay for that type of wool is 1s. per lb., it is quite obvious that the price the grower could get for the greasy wool is 6d. per lb. The main advantage from the grower's point of view of baling wool of light qualities together is that a truer yield can then be estimated on any one quality (or what is known as Bradford count); thus, if a grower prepares his clip cleanly and evenly for market, he generally gets the benefit of any doubt, especially if his type of wool is sought after by a number of buyers at any one sale.

Farmers are often heard discussing the whys and wherefores after a wool sale. The commonest argument is generally about the variation in prices. For instance, two men with the same class of sheep, the same quality of wool, sold at the same sale, may have a difference of many pence per lb. in prices realised. For this there are many reasons, but the main, or usual, cause is that one man has been a little more careful in preparing his clip, and has kept the heavier conditioned fleeces away from the lighter ones. This practice gives the buyer a better chance to estimate the yield of that wool. The other farmer has probably mixed together both light and heavy conditioned wool, and therefore only the rough estimate can be arrived at, where both seller and purchaser have a chance of falling in on the one deal.

The interlotting of the small clips has proved a success. This ensures a far better sale on account of the brokers interlotting similar wool from the small man and making bigger lines for sale. This has given general satisfaction to their clients. The wool must be shown to advantage in the woolbrokers' warehouses, and if it is got up in an attractive manner, the buyer's first impression is good. This is an important factor, because the most successful buyers make up their minds in a few seconds as to the merit of the lines before them.

The shearing season on the farm is one of great importance. Wool growers are neglectful in the manner in which the clip is put on the market. Any grower who knows how to look after his flock during the year has only to apply the same care to the classing of his wool.

When the fleece is shorn from the sheep it lies on the shearing floor with the clean cut end of the staple uppermost. It should be carefully picked up by gripping the two britches, one in each hand, and gathering in the rest of the fleece by an inward sweep of each arm. By sustaining hold of the two britches and throwing the rest of the fleece gently away from him, the picker-up should be able to spread it neatly, without causing any break in it. One of the important things for a small grower to know is the skirting of fleeces. Never take, by skirting, any wool from the fleece that should be left on, and never leave on any skirtings that should be taken off. Remove all portions round the edge of the fleece which are not similar to the remaining part of the fleece. The wool to be removed is the seedy, burry, and stained wool. When the fleece is skirted there should be nothing but clean, even-stapled wool. The fleece is now ready for rolling as follows:—One side, a third of the width of the fleece, is folded in, the folded portion is next turned right over to the farthest side of the fleece so that it is now folded in three laps with the back showing on top; it is then rolled from tail to neck. The back—which is the worst wool—is by this means rolled in the centre, which is a decided advantage over the old style of rolling. Thus the best of the wool is showing around the whole of the fleece giving it a clean appearance.

The object of wool-classing is to obtain the best results for the wool clip by doing the work skilfully. It stands to reason that a properly got-up clip will inspire buyers with confidence, which means better competition and better prices. To attain results too much care cannot be taken. The buyer must be able to fix the price on the wool with a minimum amount of trouble. This is impossible unless the wool is classed in such a manner that the contents of the bales are more or less uniform, of the same quality, and marketable value. If the work is not properly done it is impossible for any buyer to make a reliable valuation, in which case he naturally leaves a fair margin on the safe side—a direct loss to the grower for neglect in classing.

It is a simple matter to class a big clip on the farm, but not so when there are only a few bales from a mixed flock. Do not place the fleeces into the bales from the wool table; have or erect temporary wool bins in the shed. The wool can then be classed as follows:—The AA combing wool, consisting of all the lightest-conditioned, long-stapled, bright colour, sound wool, *not tender*. The A combing wool would consist of heavier-conditioned, shorter in length of staple, not so bright in colour, yet sound, not tender. Keep out all unsound or tender wool and brand same "fleece." The skirtings should be carefully picked over, and if the number of sheep warrants it, two classes

should be made– AA pieces and A pieces. If there are only a few hundred sheep, one class only is necessary after removing stains. Stained wool must be kept separate from good white wool. Belly wool should have the stains removed and be baled separately. Do not pack belly wool with both fleece wool and pieces. That practice is not correct, and the sheep owner who puts up his clip in such a manner must receive low prices. In classing lambs' wool it is necessary to pick up same between two boards, and to have the wool table covered with a sheet of calico. Never pick up more than one lamb's fleece at a time, as this causes a lot of extra work in sorting the wool by the table hands.

If the lamb's wool is free from burr and seed, the bulk of the long, bright, wool from the shoulder, back, and sides can be picked out and put in the AA lambs; the shorter and heavier wool in the A lambs. Do not mix cross-bred lambs' wool with merino. Locks consist of second-cuts and fribs that fall through the wool table. There is a marked difference between table locks and the sweepings from the shearing floor. The first named are cleaner and lighter than the latter.

Pressing.—Every farmer should possess a wool press if possible. The neatness and outward appearance of a bale indicates that care and attention have been paid to get up the clip.

Branding.—It is advisable to brand with the name of your farm. It is a mark of identification, and can be traced from the beginning of the career of the bales to the end. It shows, at all events, that the grower is not ashamed of his clip. Above all things, pack honestly, if the full market price is to be received.

In conclusion it is desired to bring before the farmers the fact that it pays to class the clip properly. When there is carelessness shown, the value of the wool will certainly fall. No buyer is going to pay for neglect of the grower.

FRUIT FLY BULLETIN.

A revised edition of the *Bulletin* dealing with the Fruit Fly has been issued by the Department of Agriculture. It contains all the latest information concerning the pest, the results of recent baiting and trapping experiments, and numerous illustrations. The *Bulletin* may be obtained free on application.

CLOVER HAY.

Reasons for its more extensive Use, and Hints on Making.

A. B. ADAMS, Dipl. Agric.,
Agricultural Adviser.

Although clover-hay is not considered quite equal to a well-cured sample of lucerne-hay, it ranks a very close second if cut at the right time and properly cured. There are but few analyses of clover-hay published, other than those of the clovers more commonly grown for hay in Europe and America, such as Crimson and Red Clover.

Under our conditions most of our paddocks are growing annual clovers, but that these have a high feeding value, when properly treated at the stage of growth when they would be cut for hay, may be realised by noting the high stock-carrying capacity of the land at this time and the rapid way in which these relatively large numbers put on condition.

ADVANTAGES AS A FOOD.

Some of the dietetic advantages of clover-hay have been dealt with previously (see "Minerals and Health of Cattle," page 113, *Journal* for June). A further advantage is a greater percentage of protein or flesh-forming material which makes it more suitable for young growing stock and milking or breeding animals.

ECONOMIC ADVANTAGES.

In comparison with an annually sown crop there are—

(a) Saving in labour of ploughing, etc.

(b) Saving in cost of seed.

(c) The grass can be grazed until the end of August or middle of September, according to the district and variety of plant.

In early summer many farmers have far more feed than their stock can consume at the time. It may be laid down as an axiom that unless the farmer has a large excess of feed from October to December he is hopelessly overstocked for the rest of the year. Generally this excess feed is left in the paddock to form natural hay. The only advantage is that plenty of seed is shed for the following year. The drawbacks are many—

(1) The leaves are soon lost, and the leaves are the most digestible part of the plant.

(2) The stems ripen and become hard and woody.

(3) The material is so bleached by sun and weather that the food value is much depreciated.

(4) The trampling of stock destroys a great deal.

(5) There is always danger of a grass fire leaving the paddock bare.

ADVANTAGES OF HAY.

When made into hay there are many advantages—

(1) It can be cut at the most nutritious stage.
(2) Once made under proper conditions will not deteriorate.
(3) There is less risk of fire.

For these reasons the same crop will carry the same amount of stock for a longer period and keep them in better condition.

MANAGEMENT OF PADDOCK.

To get the best results the paddock must be—

(1) Manured with a sufficiency of a phosphatic manure. Superphosphate at the rate of 1cwt. to 1¾cwts. per acre being, as a rule, the most satisfactory.
(2) Be mown only in alternate years.
(3) Should not be mown until there is a thick stand of clover.
(4) Should be chain harrowed during the winter to break up and distribute droppings.

It must be remembered that the bulk of the herbage in our grass paddocks consists of annual clovers, and if these are mown before there has been opportunity for a lot of seed to drop, there is great risk of the stand of grass being spoiled for the following season. As in the seed of annual clovers there is usually a big percentage of hard shelled seeds which do not germinate the first season, there will be little risk of injuring a paddock if mown in alternative years.

These remarks do not apply to biennial or perennial grasses and clovers, as if intended for hay, it is better to mow these every year and graze but lightly.

In the absence of chain harrows, spike harrows on their back can be made to answer the purpose; or even strong pig netting with a draught beam and rails across to weight it sufficiently to break up droppings.

HAY-MAKING.

The machines required for hay-making are a mower and horse hay-rake. The size of mower will depend on the power available and the area to be cut. When buying, select a machine that has the divider shoe on outer end of cutter bar mounted on a wheel. In rough paddocks this helps to prevent the point of the shoe sticking in the ground and causing breakages. It is necessary to have at least one spare knife, that one may be sharpened while the other is in use. For grass the knife must be sharper than is necessary for wheat or oats. An ordinary hay-rake is preferable to a side delivery machine, as if the crop is at all light the latter machine makes the windrows too small, these taking more labour when putting into shocks.

The best time to cut is when the bulk of the plants is in flower.

When making either clover or lucerne hay in this climate the greatest risk of loss will be from dryness rather than rain. The best and most nutritious portion of the crop is the leaves, and if the hay is too dry when handled these break off and are lost. It is not advisable to handle during the middle of the day in hot drying weather.

The best method is to cut one day; rake into windrows the following day if sufficiently dry. If the weather has been overcast it may be necessary to leave another day. When it will rake clean it is dry enough. The raking is best done early in the morning while the leaves are soft. If they become too dry and are shedding, leave until the evening or next morning

Put into good big shocks directly after the rake, and leave for a day or two. The leaves dry quickly and the stems slowly, and in the shock the leaves take up and transpire moisture from the stem.

In shock the hay will cure without suffering injury from either rain or sun, and there is but little risk of firing in the stack if properly cured in the shock.

Should there be heavy rain while the crop is in shock do not disturb it until the weather is settled, then turn the shocks over to give the part that has been on the ground a chance to dry.

CARTING.

The carting should not be commenced until the hay is properly cured.

If very drying weather it is best to cart early in the day and in the evening to avoid losing the leaves. The writer found when making lucerne hay in South Africa that although large stacks were built of hay loaded with the dew on they never heated much nor went mouldy, because in the process of loading and stacking in a dry climate the external moisture was evaporated.

At least one case has come to the writer's notice when the hay was nothing but stems, because the crop was handled too dry and all the leaves were lost.

STACKING.

As clover, like lucerne hay, does not shed rain well it is preferably stored in sheds which is the most convenient method. Especially is this desirable when the hay is to be kept for winter feeding. When it is to be used as summer feed, and is therefore unlikely to be injured by rain, it may be stacked in the open in the handiest place for use, giving the top a good pitch in case of rain.

Before building, a foundation of poles of scrub should be laid down to keep the hay from the ground and give ventilation, otherwise some of the hay at the bottom is sure to spoil.

When building, the centre of stack should be kept full to prevent rain running in from sides.

After the stack is built a fire break should be kept round it.

Having got the hay, feed it to the stock as soon as the paddocks are getting bare. It is easier to keep stock in condition than to feed them up when they are poor.

DOG-PROOF FENCES.

J. H. Langfield,
Manager, Merredin Experiment Farm.

The question of running sheep has for a considerable time engaged the attention of the wheat farmers in the Eastern agricultural areas, but so far very few farmers have sheep, the principal reason being on account of the wild dogs. The additional work involved in yarding the sheep at night and otherwise protecting them, together with the periodical losses caused by the dogs getting among them (for their visits are not always confined to night time) has caused most farmers to delay in stocking, hoping in the meantime that settlement would drive the dingo back. Up to the present, however, they seem just as plentiful as ever, due no doubt to the protection afforded by the large tracts of sandplain which are to be found in almost every district.

Dog-proof Fence, Merredin Experiment Farm.

Rabbits are also very bad in these districts, and the damage to crops has been so great that many farmers have decided to rabbit-proof their holdings. Any farmer who decides to rabbit-proof his farm should also consider whether it would not pay him to dog-proof it as well.

To the average man a dog-proof fence suggests something unusually high and costing considerably more than the ordinary rabbit-proof fence;

but the experience at the Merredin Experimnet Farm has proved conclusively that the extra cost in making a rabbit-proof fence dog-proof is very small indeed. The Merredin Experiment Farm was enclosed with rabbit-proof netting in 1914; and later an endeavour was made to keep the dogs back by placing barbs over the netting. The specification of the fence was as follows:—posts 8ft. 6in. apart, netting 6in. in ground and 3ft. out of ground, barb 5in. over the netting, plain wire 4in. over barb, and a second barb 5in. over the plain wire, or a total height of 4ft. 2in. The losses, however, were still considerable, the dogs coming in both day and night. One day the dogs came in during the dinner hour and killed 15 sheep. On making an examination of the fence it was found that the dogs came in directly over the netting between that and the first barb, as dog hair was found in many places sticking on the barb, and whenever dogs were chased out of the paddock they always went through the fence and never over it.

In order to stop them getting through it was decided to try bracing the fence with No. 16 wire. Three braces were put on each panel. The bracing wire was securely fastened to the top of the netting. It was then given a turn around the barb and the plain wire, and then secured to the barb on top. This made it very rigid, and the barb would not lift away from the netting to allow a dog to pass through.

Rabbit and Dog-proof Gate, Merredin Experiment Farm.

The sheep were then left unyarded to test the result, and so satisfactory has it been that it has not been necessary to yard a sheep at night for the last three years; none has been lost from dogs, nor has a dog ever been seen in the paddocks.

Evidently dogs do not care to go over a fence which has a barb on top. It is therefore necessary to secure the other wires so that they are unable to get through, and this can be accomplished by bracing.

That there were plenty of dogs on the outside of the fence was proved from the results obtained by trapping along it. It was realised that when the dogs came to the fence and could not get through they would naturally

go along it trying to find a place to get in, so traps were set outside in an endeavour to catch them, and 14 were caught during the first 12 months.

The extra cost in making the rabbit-proof fence dog-proof was very light. In any case it is necessary to have at least two wires over the netting, one of which should be a barb, so the only additional material required was one barb and the bracing wire. One cwt. of bracing wire will do approximately two miles, whilst a man will brace on an average thirty panels per hour.

With fencing posts both scarce and dear there is no reason why a fence with 12ft. panels should not be equally as successful, but with a wider panel it would be necessary to have an additional brace.

Many hundreds of miles of netting have been approved of to the farmers of this State by the Federal and State Governments. Once a farmer has his holding netted he should run sheep, as the returns will very soon pay for the cost of the fencing. If he does not make it dog-proof he is going to have endless losses, whilst yarding the sheep at night, especially in wet weather, is responsible for the loss of many lambs. The wool also becomes dirty, and the price realised is very much lower than it would be from sheep that are not yarded.

Even if a fence proves to keep the dogs back, the war against them should never be relaxed, for the only way of securing immunity from their attacks is to exterminate them.

MINERALS AND THE HEALTH OF CATTLE.

(No. 2.)

A. B. Adams, Dipl. Agric.,
Agricultural Adviser.

The very great importance of a sufficiency of phosphates in nutrition has been demonstrated by a series of experiments in South Africa ("Phosphorus in the Live Stock Industry," by A. Theiler, H. H. Green, and P. J. du Toit, Journal of the Department of Agriculture, South Africa).

The definite experiments discussed by the joint authors were commenced in 1920, and are of great significance not only in South Africa but in all countries that have districts where the soil is naturally deficient in available phosphates. The conditions on the farm where most of the experiments were carried out are different to those familiar to the writer in the South-West, but it is quite possible that there are areas in the dry districts of Western Australia that are very similar. Most of the results obtained apply to all other conditions if the one condition, a deficiency of phosphate in the soil, is present.

Before discussing the experiments it will be well to define the soil and grazing conditions of the farm where the bulk of the work is done. The soil was very low in available phosphoric acid and on much of the area high in lime. The rainfall is low and is the limiting factor in growth. The stock-carrying capacity is roughly 20 acres to the beast. The cattle on the run were all addicted to bone chewing (*osteophagia*).

The experiments comprised—

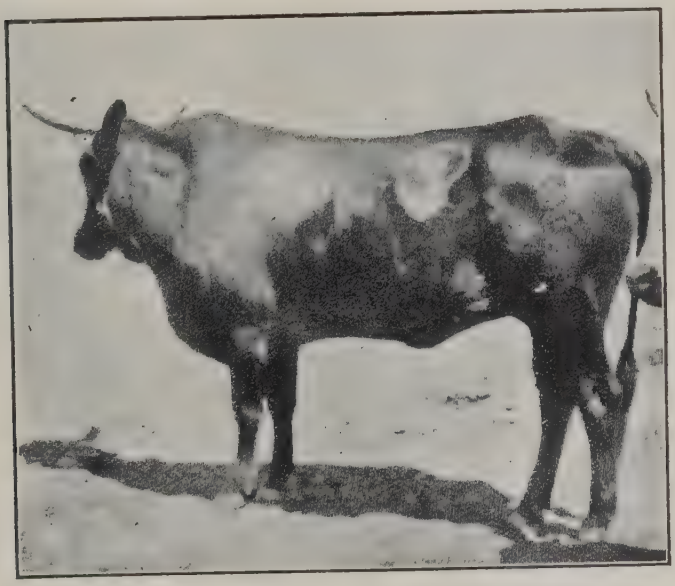
1. Bone meal feeding to—(a) calves, (b) young cattle, (c) mature oxen, (d) milking cows.
2. Manuring of pastures.
3. Feeding substances containing phosphoric acid in comparison with bone meal.
4. Feeding minerals that did not contain phosphoric acid.
5. Influence of phosphoric acid on food consumption.

1.—BONE MEAL FEEDING.

In experiments under this head the only difference in feeding was in the amounts of bone meal feed; as will be seen from the illustrations the results were wonderful.

(a) With calves weighing about 300lbs. live weight at commencement of the experiment. The experimental calves received 18ozs. of bone meal per week each. The controls received none. The results can be seen in Fig. (1).

In another series some of the calves received 3ozs. per day except Sundays, others just sufficient to prevent bone chewing, and the controls, as before, none. The representative results can be seen in Fig. (2). This ex-



Showing influence of Bone Meal on condition of stock.

periment proves that bone chewing shows an acute shortage. Even if the animal is not chewing bones, it may not be receiving sufficient phosphoric acid for maximum growth.

(b) A number of 3-year old cattle as nearly similar as possible, restricted to natural veldt grazing; some received 3ozs. bone meal per day; the controls none. Fig. (3) shows the difference made by bone meal at the end of fifteen months; the two animals were similar at the commencement of the experiment.

(c) It was found that mature oxen did not need as much as the other classes of stock, their bone meal requirements ranging from nil when the grazing was at its best to 9ozs. per week at the worst time of the year.

(d) For mature breeding coows, to prevent *osteophagia,* the demand varied from about 4ozs. per week, before calving and while the grass was good, to 28ozs. per week when the grass was poor and milk production still fairly high. The extra demand is accounted for by the amount secreted in the milk. These cows were kept for breeding purposes and reared their own calves. With very high producers the requirements would have been still greater; the authors estimate that 8ozs. per day should be given to high yielders.

In an experiment on milk yield the cows receiving excess bone meal gave 40 per cent. more milk than those receiving none; as this result was obtained with ordinary cows that just gave enough milk to bring up their calves more striking results can be expected from dairy stock.

2.—MANURING OF PASTURES.

Manuring the grass with superphosphate was tried and found successful as a preventative of bone chewing. It was not economically profitable with low rainfall conditions, as although it improved the quality it did not increase the quantity of feed sufficiently to be a commercial proposition. When the conditions are such that the application of superphosphate increases the quantity as well as the quality of the feed, top-dressing is no doubt one of the best and most profitable ways of increasing the amount of phosphoric acid available to the stock.

3.—OTHER SUBSTANCES CONTAINING PHOSPHORUS.

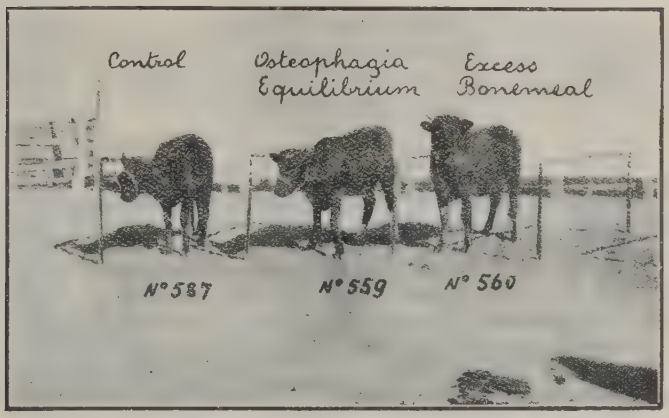
Of other substances tried it was found that one lb. of bran took the place of one ounce of bone meal.

Ground rock phosphate was not thought to be sufficiently soluble. It must be remembered that these results were obtained on country rich in lime; on country deficient in lime the writer got good results with ground rock phosphate, and it is probable that bran would require to be supplemented with lime in some form if the grazing were deficient in calcium salts.

Superphosphate alone was found sometimes to cause digestive troubles.

Other salts of phosphoric acid were tried and stopped bone chewing.

The great advantage of bone meal was that the cattle recognised it and took it readily.



Showing that the amount of Phosphorus required to prevent Osteophagia and so protect against Lamsiekte is not the Optimum for Growth.

Weight.	No. 587.	No. 559.	No. 560.
January, 1922	224 lb.	237 lb.	226 lb.
May, 1923	390 lb.	532 lb.	578 lb.
Increase	166 lb.	295 lb.	352 lb.
Total bone-meal supplied ...	Nil.	15 lb.	75 lb.

Showing influence of Phosphorus on Growth of Cattle, otherwise restricted to Natural Grazing.

Weight.	No. 518.	No. 475.	No. 502.	No. 528.
January, 1922 ...	310 lb.	319 lb.	304 lb.	297 lb.
May, 1923	755 lb.	465 lb.	726 lb.	451 lb.
Increase	455 lb.	146 lb.	422 lb.	154 lb.
Bone-meal ration ...	3 oz.	Nil.	3 oz.	Nil.

4.—OTHER MINERALS.

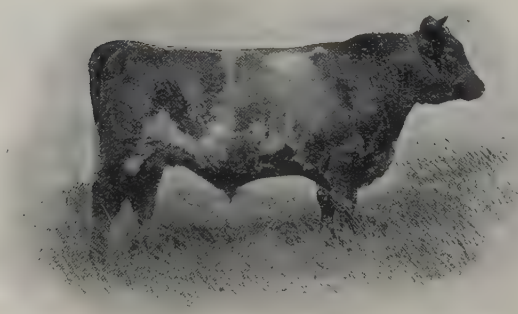
Of other minerals chalk, Epsom salts, Glauber salts, iron sulphate, sulphur, and various other substances were tried. In the absence of enough phosphoric acid, none of these gave any result.

5.—ON FOOD CONSUMPTION.

The effect of bonemeal on food consumption was to slightly increase the amount of fool eaten, but to greatly increase the live weight. The effect of phosphate in the ration is comparable to the effect of a vitamin in nutrition. To quote the authors "Cattle on a phosphorus deficient diet do not utilise their food economically. Even if they eat a lot they waste it. If the deficiency is rectified with bonemeal feeding, they may eat more but give much better value in beef for all they eat."

Among the results of the experiments, it was found that it is best to feed the bonemeal often, and that it should be fed three times a week to get the best results.

If cattle are not doing as well as could be expected, it will pay the stock owner to try the feeding of phosphates in some form as recommended in the *Journal* for June. These South African experiments have definitely shown that bone chewing is a symptom of acute shortage, and even if bone chewing is absent it is possible that the stock are not getting sufficient for maximum growth, particularly when running on land known to be deficient in phosphoric acid.



DOWNY MILDEW.

(Sclerospora macrospora.)

An unusual disease of Wheat.

W. M. Carne,
Botanist and Plant Pathologist.

The accompanying photo. illustrates an unusual disease which appeared in a crop of Major wheat at Three Springs last year. The trouble was confined to this particular variety, and also to a portion of the crop which was waterlogged as a result of the exceptionally heavy rains. The seed was obtained from Victoria. This is the first published record of its occurrence in Western Australia.

Wheat affected by Downy Mildew.

Downy Mildew is unlikely to be serious in this State, except in very wet soils. This note is published for the information of growers, and in hope that further information may be elicited as to its occurrence in this State.

The following information is compiled largely from an American publication on the subject.*

Downy Mildew is restricted almost entirely to low-lying, poorly drained, fields in which the young seedlings of wheat have been subjected to excessive moisture. It occurs especially in places where water has stood. Oats, maize, and a number of grasses are subject to attack as well as wheat, but the disease has not yet been recorded on these plants in this State. In parts of Europe, notably Italy, it is a serious disease of wheat. It is also known in North America

Symptoms.—Diseased plants develop symptoms approximating to one of the following types:—

(1) The young plants show excessive stooling, grow to a few inches high, wither and die.

(2) The plants are short and stunted with thick stiff fleshy leaves of a distinctly yellow colour. The colour is a dull yellow quite distinct from the brownish-yellow of dying leaves. Dwarfed stems with malformed heads may be formed, but with few, if any, normal grains.

(3) The plants are nearly normal in height with distorted ears, but are otherwise similar to the preceding type. Portions of the plants may be apparently healthy, though the heads are small and poorly filled. The plants illustrated are of this type. That on the left has one nearly normal stem with a small ear (not shown in the photo.). All the other stems are more or less affected.

The Department of Agriculture would be glad of specimens if the disease is noted this season, together with particulars as to origin of seed, soil conditions, estimated loss, and any other points which may be noted.

* Weston, W. H.—The occurrence of Downey Mildew of Wheat in U.S.A. U.S.A. Department of Agriculture, Cir. 186. 1921.

ANTS AS PESTS.

J. Clark, F.L.S.,
Assisant Economic Entomologist.

Western Australia with its sunny and comparatively mild winter climate is an ideal home for insect life, and has a greater number of ants than probably any other country, yet it has very few species which can be looked on as serious pests to the farmer or orchardist. This is no doubt due to the fact that the majority of our ants are omnivorous. Some, however, are entirely insectivorous, living on insects of all sorts, which are so abundant, and which they greatly help to keep in check.

We also have various species of harvesting ants, which live almost entirely on the seeds they collect. None of these ants, however, have been known to gather the seeds of cultivated plants here. All of them make use of the seeds of native grasses and small native plants.

Some ants collect seeds and other small pieces of material to build their nest. These seeds, however, are not used as food, and it is generally the large seeds of trees and shrubs that are used.

A moment's reflection on seeing a large ant-nest indicates that a great quantity of food must be consumed each day, and when it is considered that ants are the most numerous animals in the bush, it will be realised that a heavy toll is exacted from the various species of insects which serve as food for the ants.

Unfortunately the ant does not discriminate between the beneficial and the injurious insects, but takes all that it can get. It frequently happens that a large source of this supply is obtained from our beneficial insects, which are sometimes destroyed in great numbers, so that the benefit we should receive from the ants as insect destroyers is greatly reduced, as they kill off our friends as well as our enemies.

The house fly in Fiji is kept in check by a small ant which destroys the larvæ and pupæ of the fly, but while the same ant (*Pheidole megacephala*) is abundant in Western Australia, I have never known it to frequent the breeding places of the fly. It plays no part in fly control in this State.

Occasionally one sees articles in the newspapers advocating the introduction of ants from Africa to destroy the rabbit pest. This suggestion is a dangerous one, as these ants (Driver Ants) are by no means particular as to what they shall have for dinner. They travel over the country in large companies and destroy all forms of life that they encounter. Ants are too easily introduced into other countries, and when once established generally become pests and almost impossible to eradicate. This can be seen from the spread of the dreaded Argentine Ant (*Iridomyrmex humilis*). Originally found in South America, it has gradually spread over a large portion of the Southern States of North America, and has been recorded from Ireland, England, France, and other parts of Europe. It is also well established in South Africa, and is recorded from various parts of Asia.

This ant is an omnivorous feeder, and as a household pest is equally as bad as it is in the garden and orchard. At present it is not found in Australia, although the genus to which it belongs has its headquarters here. The

Australian species, however, are of minor importance, with the possible exception of one species commonly known as the meat, or mound ant (*Iridomyrmex detectus*), which appears to be well on the way to become a pest of some importance. It is one of the commonest and most widely distributed species, being found in all the States of Australia. The nest is a common feature in most of our towns as well as in the bush. These nests measure from a few inches to a few feet in diameter, and extend a consider-

Typical nest of the Meat Ant.

able distance underground. Some idea of the internal size of the nest may be gained from the height of the mound, as the whole of this material is excavated below and carried to the surface. A prominent feature of these nests is the bare, beaten tracks, some inches wide, leading away in all directions.

It is rather a pretty ant, the common worker being light red with a purple abdomen, the red parts frequently having a violet sheen, and the body measures about half an inch in length. The female is almost twice as large as the workers, and in colour is dark purplish.

This ant does not sting, but it bites very sharply, as most people know who have stepped on a nest. They are very aggressive and rush out in thousands at the least alarm, all eager to sample the intruder. They frequently construct their nests near gateways and paths, and thus they make their presence felt.

They are highly carnivorous, and destroy large numbers of insects, but like most of the group are very fond of the secretions given off by Aphids, scale-insects, mealy-bugs, etc., also the nectar of blossoms, which they frequently destroy. When a nest is located near fruit or other trees infested

with sap-sucking insects, the ants will be found swarming all over the trees, tending the insects and obtaining the honey-dew. In this particular they are a serious pest, as they protect these sap-suckers from their natural enemies, the lady-bird and its larvæ, the Chalcid wasps, etc. These are destroyed by the ants, with the result that where they are numerous so too is the food supply, which increases greatly as the parasites are either destroyed or driven away. The result is that the orchardist has to continue to spray in order to try and control the pests which are so highly protected by the ants, which he is helping to propagate by allowing the nests to remain near his property.

In addition to tending these insects on the trees, the ants rear many mealy-bugs and aphides in the interior of their nests. These are generally attached to roots, and are found to be most numerous from May to October, when they again leave the nests or are taken out, and continue their existence on the host trees or plants.

A new and disquieting feature in connection with this ant has been observed in New South Wales. Mr. K. C. McKeown, writing in the *Australian Zoologist* (Vol. 3, pt. 5, p. 178), says of this ant:—"The meat ant (*Iridomyrmex detectus*) also finds citrus trees to its taste, and, somewhat after the manner of the South American Parasol ant, cuts off the small leaves and twigs, and strips the soft bark from the young growth and carries the fragments off to the nest. This acquired taste is becoming more prevalent and widespread each season, and frequently causes considerable damage." So far I have not seen this ant act in this manner in this State, nor have I been able to find any record dealing with the subject.

When native insects turn their attention to fruit trees they are a very difficult problem to deal with, and prevention is better and cheaper than cure, so that orchardists should take every precaution by exterminating all nests of this ant found near their property, and so safeguard themselves and give their insect friends a chance.

These nests are easily and cheaply exterminated by the use of carbon bisulphide used in the following manner:—Early morning, before the sun gets strong, is the best time to deal with the nest. Take a wet bag, or several if the nest is a large one, and cover the greater portion of the mound with same. These are then covered with earth or sand to help to make them gas-tight, leaving a space near the middle of the top clear. When the mound is covered a crowbar or other instrument is thrust down into the nest through the clear space to make a fairly large hole; pour into this hole a cupful of carbon bisulphide and quickly cover the hole with earth to retain the fumes. These penetrate into every part of the nest and destroy all insect life. I have never known a nest so destroyed to be again occupied by ants. Carbon bisulphide is explosive, so keep all lights away from it.

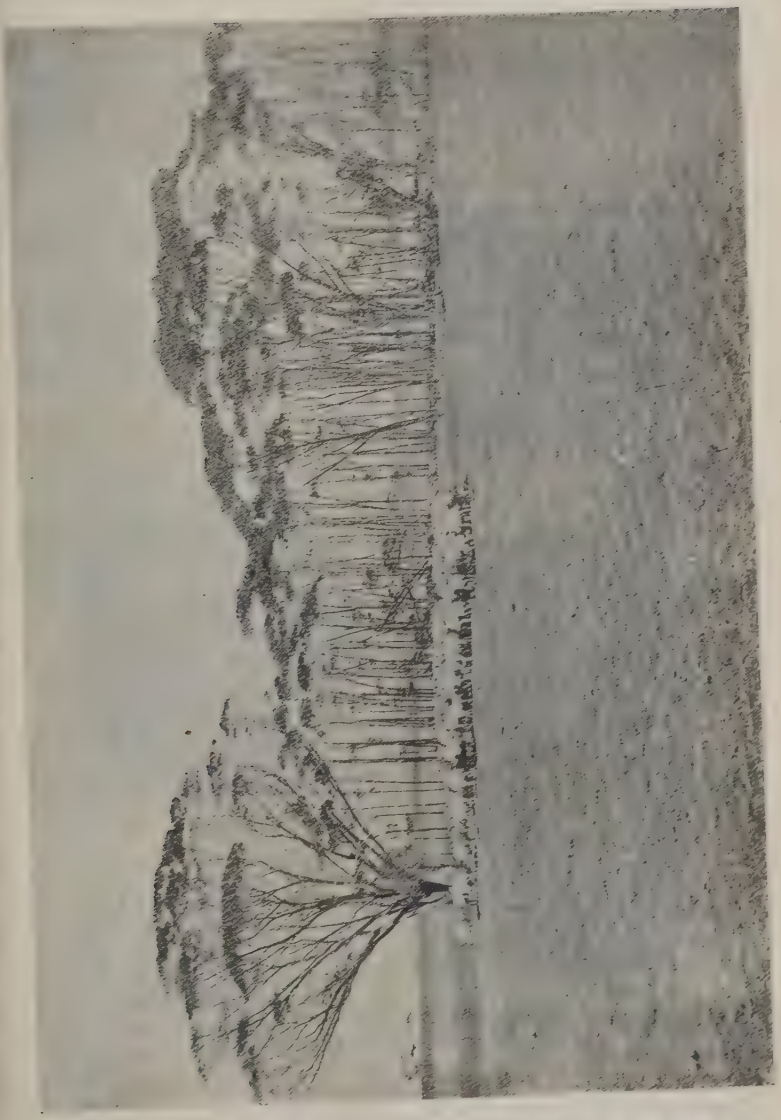
THE FARMER'S WOODLOT.

"M.G.D.," of the Forests Department.

The policy of the average man taking up land in Western Australia, namely of removing every stick of timber from his land to make way for other crops, is a very short-sighted one. Many farmers who have followed this policy in the past now find themselves absolutely dependent on outside sources for the timber for their general farm and building requirements. Now, there is on almost every farm a certain percentage of land unsuitable for the growth of agricultural crops, and here should be established what is known in America as the farmer's woodlot. In the United States practically every farmer has his woodlot, which may be either a patch of timber already growing on the land that cannot profitably be utilised for the usual crops or else an area planted by the farmer with young trees, which may be sold at maturity. In either case the farmer annually reaps from his woodlot just that amount of timber which it is capable of growing yearly, so that he has a constant supply of timber for all his needs, and, in some cases, is able to sell much of his wood for profit to neighbours with less foresight. The Forest Service of the United States is ever ready to aid the farmer in the cultivation of his timber crop. If he possesses a strip of indigenous timber, advice will be given as to what trees to cut down and what to preserve, what species should be planted on bare patches, and so on. If, however, he has planted his own woodlot with trees that are not native to his particular locality, he may seek the help of the Forest Service in selecting and planting different species. As a matter of fact, the farmer's woodlot in America may be regarded as a miniature cultivated forest.

Western Australia, like most young countries, made the initial mistake of giving away, as incentives to settlement, large areas of prime forest, which have been recklessly cut out without thought for the morrow. Too late has it been realised that the end of the State's timber is now in sight, and that, if it be desired to provide a continuous supply, future cutting must be regulated. Forest authorities throughout the world acknowledge that a universal timber famine is threatened, and in most forested countries efforts are being made to conserve and augment existing supplies. This work, of course, is primarily a function of Governments and is being treated by them, in many cases, as a pressing duty. But is it not also the duty of those individuals who are in a position to do so to help the Government in its work of sustaining the timber supply of the community? Every farmer can do his little bit by utilising the waste patches on his holding for the propagation of indigenous trees, or for the planting of softwoods or trees yielding valuable bark. If, say, an acre a year be planted for some years, then, when the trees arrive at a marketable age—after some 20 years in the case of pines, or 10 to 14 years for wattles—the first acre could be cut out and replanted, and so on each succeeding year, a sustained yield of timber being thus assured. The work will cost the farmer very little in labour or cash—young trees being obtainable at a cheap rate from the Forest Nursery at Hamel—and the monetary return for the timber, or, in the case of wattles, for the bark, will well repay any slight trouble involved in the commencement of a woodlot.

There is no reason to suppose that the forest authorities of Western Australia would prove less willing to assist the farmer in a tree-planting campaign than is the Forest Service of the United States of America. It stands to



Trees providing shade for stock.

reason they would be only too glad to encourage a scheme of the nature outlined above, which would point to a realisation by the producer—who is, after all, the backbone of the community—that our forests are not inexhaustible, and that the timber crop is just as important to the country as other agricultural crops.

SOME DISEASES OF APPLES.

W. M. Carne,
Botanist and Plant Pathologist.

Western Australia is very fortunate in its freedom from fungus diseases of apples. In consequence the use of fungicidal sprays, except in the form of a general purpose spray of lime-sulphur in the winter and early spring, is rather exceptional.

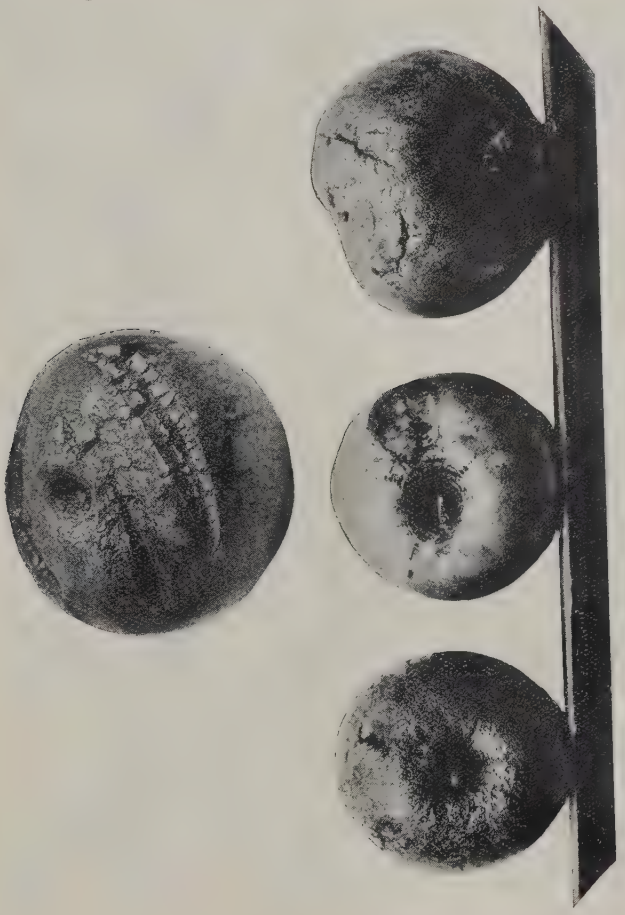
The russeting and cracking of apples, especially the variety known as Dunn's, has become sufficiently common to seriously prejudice growers against this variety. In addition certain canker fungi, which result in the development of cankers of the stem and dieback of twigs, occur to a limited extent.

This article deals with the fruit cracking and twig dieback or canker which have been found to be associated with the same fungus (*Coniothecium sp.*). While it must be admitted that it has not yet been definitely established that this fungus is responsible wholly or in the main for these troubles, the evidence certainly points in that direction. In conjunction with certain growers the Department is carrying out spraying tests this coming season. Growers who may be interested are invited to experiment for themselves along the lines suggested at the end of this article. The Department will welcome any information as to the results of such experiments.

Russeting and Cracking of Dunn's Apples.—This widespread, and at times serious, trouble is most marked upon Dunn's, but affects other varieties to a lesser extent, especially Rokewood, and other hard varieties. It is sometimes mistaken for Apple Scab (*Venturia inequalis*), a disease not known in this State. A fungus called Coniothecium, which forms irregular chains and masses of dark brown cells, occurs in association with the trouble. In England, South Africa, and Tasmania a somewhat similar trouble is associated with a species of Coniothecium (*Coniothecium chomatosporum, Cda.*), which may be identical with that found here.

Symptoms.—A dark brown russeting of the stalk end of the fruit is the first symptom, which may appear while the fruit is still very small. It consists of innumerable minute cracks in and amongst which the irregular growth of the fungus may be detected with the microscope. The affected tissue becomes hardened, and with the growth of the fruit, cracks. In bad cases the disfigurement may be so great as to preclude the possibility of marketing the affected fruit. Descriptions of the trouble caused by Coniothecium attack in the countries mentioned above indicates that it attacks any portion of the fruit, including the calyz end. In some cases russeting occurs as a broad band more or less encircling the fruit. In one case last season this type of trouble occurred to some extent in an orchard on the Kalgan River. (This form of the disease is considered by some authorities to be due to frost.) Normally, however, the trouble with us is confined to the stalk end. It must be recognised here that cracking is not necessarily due to the attacks of fungi. It may be due to irregularity of growth, rain on maturing fruit, etc.

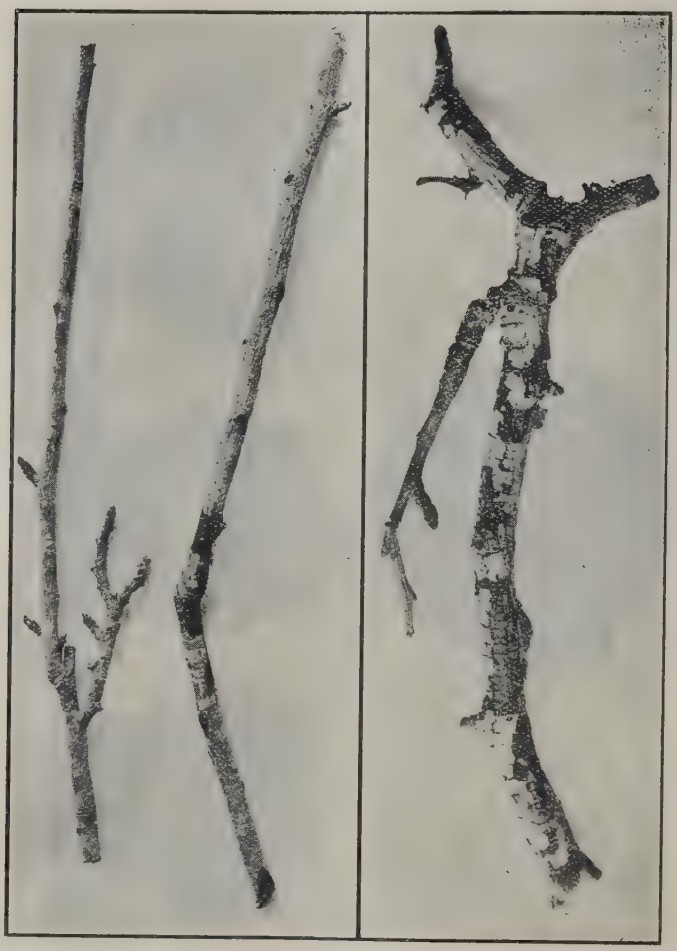
The organism consists of irregular masses or chains of dark brown cells, which in turn give rise to other cells. Grown in pure culture on potato dextrose agar the growth is at first white, but dark areas develop and gradually extend. Numerous small colourless or olivaceous spores are given off by budding from the mycelium submerged in the medium. No perithecial or ascigerous stage has yet been developed.



Dunn's apples showing russeting and cracking associated with Coniothecium sp.

A Blister Canker or Twig Dieback.—This disease has been found on both apples and pears at Bedfordale, Mount Barker, and other apple-growing centres. It is sometimes in error called Fire Blight (a bacterial disease not known in Australia). Like the fruit cracking trouble mentioned above, it is associated with the fungus Coniothecium. The principal effect is to cause a canker on the twigs and branches. On the smaller branches the canker

develops as a girdle. As a result the branches die back to the cankered area. The first evidence of the disease is seen in the dying of the leaves in the summer. On the affected branches the skin becomes blistered, and finally flakes off exposing a blackened area beneath.



Apple branch with blister canker associated with Diplodia sp.

Pear branch showing blister canker associated with Coniothecium sp.

The fungus is to be found both on and below the blistered skin. This disease does not appear to be as common as the fruit trouble. A similar trouble has been recorded in South Australia.

Another Branch Canker.—A similar girdling canker associated with a species of Diplodia (probably *D. Griffoni.* Griff. & Maub) was obtained last season from apple trees at Capel. In this the canker is somewhat depressed and dotted with numerous black raised points. These are the pycnidia or spore containers of the fungus. A similar disease is common on apples in New Zealand.

Treatment.—No experiments have yet been carried out on the control of the above diseases. Some observant growers, however, are of the opinion that cracking in Dunn's is reduced, but not entirely prevented, by the use of a winter spray of lime-sulphur.

The following treatment is being tried this coming season:—

1. Cut out all dead wood when pruning.
2. Burn all prunings.
3. Spray with Lime-sulphur 1-7 during last week in August.
4. Spray with Lime-sulphur 1-14 when buds are bursting, but before they show any white.
5. Spray again with Lime-sulphur 1-35 as soon as possible after the majority of the petals have fallen.

The above spraying treatment is being tried both with and without the usual lime-sulphur general purpose winter wash.

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LUCERNE IN THE EASTERN WHEAT BELT WITHOUT IRRIGATION.

E. J. LIMBOURN,
Merredin Experiment Farm.

It is generally considered that lucerne will not thrive in the Eastern Wheat Belt unless irrigated. Considerable possibilities are disclosed, however, for at least small areas in the Eastern Wheat Belt by the experience with a small plot of drilled and interdrilled lucerne at the Merredin Experiment Farm.

In May, 1923, a small plot of "Hunter River" lucerne was planted in drills two feet six inches apart. The ground (heavy forest land) had been well fallowed the previous year and kept clear of weeds by cultivation. A light dressing of superphosphate, about 60lbs. per acre, was given at time of planting, and good germination results were obtained. Very little growth was made until August when, with the advent of warmer weather, it became more vigorous. Cultivation of the soil between the drills, in this case by means of the hand hoe, was carried out whenever necessary to keep down the weeds, and at the same time maintained a good mulch and so minimised evaporation. Once the weeds were overcome, however, very little cultivation was necessary, and the hoe was only used about four times during the

Lucerne top dressed. Merredin Experiment Farm.

whole season. The plants were cut back twice when the growth was about ten inches high, once during September and again during January. After being cut back in January the plants were allowed to run to seed, being cut right back again in April.

The monthly rainfall in points (100 = 1 inch) since planting has been: —May, 131; June, 479; July, 123; August, 54; September, 125; October, 34; November, nil; December, 249; January, nil; February, 38; March, 70; April, 46; May, 177; June, 200; July, 94. From this it will be seen that the rains following the planting were good, as is usual, but the spring rains were light, but the tilling of the soil between the rows enabled the plants

to make the most of them and also of the good fall in December, and in consequence, although the plot was not irrigated in any way, the *plants had remained quite green throughout the summer until April, and not one had died out.*

After the old growth had been cut back in April the plot was given a top dressing of superphosphate, about 100lbs. per acre, and again well cultivated. With the first good autumn rains (May 12th to 15th) rapid growth was made, and by the end of June there was a thick bushy growth about twelve inches high. By the beginning of August it had increased to fifteen inches, and being cut yielded green feed equal to 37cwt. per acre.

Lucerne not top dressed. Merredin Experiment Farm.

That this plant responds very rapidly to a top-dressing of superphosphate was also noticed in comparison with another plot that had not been top-dressed, although otherwise similarly treated.

Most farmers keep one or more milking cows besides laying hens, and a small plot of lucerne giving results as above would rapidly repay the extra time and cost of preparation and care required. It is rather late to attempt planting this season, but it is not too late to start preparing a plot ready for a trial next year.

The test at this farm is certainly on a very small scale, but no treatment is given that could not be applied to a larger plot. By using horse cultivation instead of hand work, a plot of from half an acre to five acres would be maintained without much difficulty.

EXPERIMENTS WITH COTTON AT THE CHAPMAN EXPERIMENT FARM.

I. THOMAS,
Superintendent of Wheat Farms.

With the object of determining the earliest date at which it would be possible to plant cotton in the Geraldton district, so as to get the very fullest possible benefit from the moisture stored in the fallow land and from the spring and early summer rains, an experiment was planted at the Chapman Experiment Farm commencing in June last year, 1923.

The ground on which the experiment was planted was a red sandy loam, previously carrying jam trees. Prior to 1922 it had been cropped each alternate year since 1913. In 1922 a crop of oats was sown in May, and it was ploughed in August to a depth of six inches. It was cultivated with a disc harrow in September and October of the same year in order to kill the weeds. In April it was cultivated with a spring tyne cultivator after rain, and again at the time when each planting of cotton was made.

The first planting was made on the 13th June, and at this time as well as at subsequent plantings the ground was free from weeds and in excellent condition. There was no germination from this planting. It appeared that the ground was too wet and cold. Mean maximum temperature was 64.5 and the minimum 48.8. During the month rain fell on 24 days for a total of 1,260 points.

The second planting was made on the 20th July. A few seeds germinated but these subsequently died off, which may have been due to the cold weather following their appearance. Rain fell on 13 days for a total of 207 points. The mean maximum temperature was 65 deg., and the minimum 46.7. There were three frosts during the month, but these did not affect the growth of the plants, as two occurred prior to planting and one on the date of planting.

The third planting was made on the 21st August, and about 50 per cent. of the seed germinated, and although at the time of writing the majority of these are still alive, they have only grown to a height of about five or six inches. During the month rain fell on 13 different days for a total of 181 points. No frosts were recorded. The mean maximum temperature was 67.50 and the minimum 46.2.

The fourth planting was on the 19th September. The germination was good, but like the plants from previous germination they have made very poor growth, and are only a few inches high. Rain was recorded on 16 days for a total of 138 points. No frosts were recorded. The mean maximum temperature for the month was 67.8 and the minimum 46.7.

The fifth planting was made in October. Germination was very poor. The growth of those which did germinate was similar to those planted in August and September. Rain fell on seven days for a total of 68 points. The mean maximum temperature was 75 deg. and the minimum 50.4.

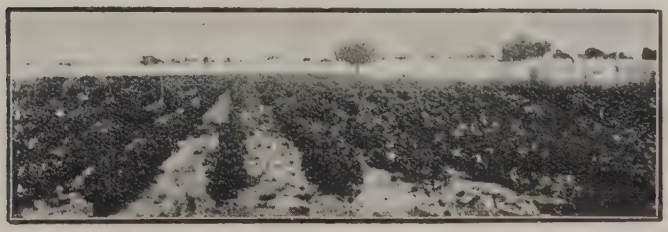
Summarised, these experiments indicate that, prior to September, the ground, though containing abundant moisture, was too cold for the cotton seed to germinate. By September the ground had become warmer, and the germination was good although the air temperatures were still below those which elsewhere are regarded as being satisfactory for the successful growth of cotton. Later on as the ground became warm enough for the vigorous growth of cotton the moisture became deficient, and so the plants failed to make headway.

An ideal climate for the growing of cotton, provided that sufficient moisture is available, should average during the growing period not less than 60 degrees F. with the warmest month averaging 80 degrees F. The average for the three warmest months should be about 77 degrees F. There should be a frost free period of about 200 days. The last requirement does not cause much concern in the Geraldton district, in which the Chapman Farm is situated, as it is almost free from frosts.

The average monthly temperatures, July to December, at the Chapman Experiment Farm for the past nine years were:—

Month.	Max.	Min.	Average.
June	67·8 ..	49·0 ..	58·4
July	65·7 ..	46·5 ..	56·1
August	66·4 ..	46·7 ..	56·5
September	71·9 ..	48·2 ..	60·0
October	75·1 ..	49·6 ..	62·4
November	83·6 ..	56·2 ..	69·9
December	89·0 ..	59·7 ..	67·4

From these figures it will be seen that results at Chapman Farm agree with conclusions drawn from experience elsewhere.



THE ESTIMATION OF THE QUANTITY OF GLUTEN IN FLOUR.

R. G. LAPSLEY,
B.Sc.Agr. (W.A.), A.A.C.I., M.R.San.I.

Gluten of flour is the name given to the sticky elastic mass obtained when dough is kneaded in a stream of water until the whole of the starch is removed. Wheaten flour differs considerably from all other cereal flours except the somewhat different case of rye flour in that it is possible to wash away the starchy portion of a dough made from it, and leave the sticky adhesive residue consisting mainly of two wheat proteins called "Gluten."

Gluten is considered one of the most important constituents of flour, and modern investigations into "strength" of flour have definitely confirmed its importance. The physical properties of flour (upon which the capacity to make good bread depends to a great extent) are centred mainly round the quantity and quality of this material, since it is owing to the presence of gluten that the baker is enabled to make a dough which will produce bread. Carbonic acid, which is produced upon fermentation of dough, becomes entangled in the gluten, and gradually distends it during the rising of the dough and the baking of the bread. For a flour to be of good baking quality, it is obvious that there must be a sufficient quantity of gluten present in the flour to retain the gas produced during fermentation, and the quality of the gluten must be such as to confer elasticity on the dough. Whilst the gluten must be highly elastic and readily yield to distention without disruption, it must also be sufficiently rigid to maintain a good shape during the process of baking.

Gluten varies greatly in quality and in colour, and this is readily noticed when washing it out. Some glutens are hard and brittle, others tough and elastic, whilst others are too elastic, and have little or no gas retaining power. The colour varies from cream to grey and brown.

Gluten, as produced by washing out, is not a pure substance, and owing to its nature specially standardised methods must be employed in order to obtain comparable or reliable results. Gluten is composed of two complex nitrogenous bodies, gliadin and glutenin, as well as mechanically or physically held fat, fibre, and other substances of complex nature.

Gluten estimation by the starch removal method, according to the conditions of time of washing operation, water composition, etc., will give varying results owing to its colloidal nature, for it is possible to wash away all the gluten by prolonged washing and especially if distilled water be used.

The approved method of carrying out the test and the standard conditions is given as follows:—10 grams. of the flour to be tested are carefully weighed out and made into a somewhat stiff dough with distilled water (about 5 ccs. usually). This ball of dough is placed on a sheet of glass and covered with a small beaker and allowed to stand one hour. The ball of dough is then washed under a fine stream of tap water over grit gauze. The ball is kept working continuously between the fingers of the hand until a certain definite

joint is created, insofar as the washing out of starch is concerned. Any small particles of gluten which become separated in the course of the washing operation can be easily collected up into the ball again. As a certain small amount of gluten is necessarily going into solution, the end point is taken for the washing out when the wash water first fails to give a blue colour with iodine solution. This blue colour disappears or fails to be produced

Apparatus used in Wheat and Flour Testing. The recommended electric Glutenizer Apparatus is to be seen in position in the foreground to the left.

before the last of the starch has been readily removed, and just when slight turbidity remains. The gluten is then allowed to stand in distilled water in a beaker for half an hour. It is then squeezed roughly dry and is weighed on a tared watchglass. This gives the weight of wet gluten. The gluten on the watchglass is then placed in a water oven, and after two hours the gluten

is removed with a penknife and cut through in several directions. The watch-glass and gluten is then removed to a air oven at 108° C. for seven hours, and then weighed, after cooling in a desiccator. The weights multiplied by ten give percentages.

The apparatus illustrated gives very favourable results.

The testing is done by means of a test-tube, in which the washings are caught and a few drops of iodine added.

The gluten varies considerably from time to time in wheats, and ranges from about six per cent. to over 18 per cent. of dry gluten.

The ratio of wet to dry gluten varies from time to time, and usually ranges between 2½ or 3 to 1, and is indicative of the moisture retaining power of the gluten when the tests have been carried out under standardised conditions.

The illustration shows the washing out apparatus for gluten in the foreground to the left. It consists of the constant head apparatus for the supply of washing water and the supported inverted bell jar. The testing tube and iodine are also to be seen with the apparatus. The illustration also shows the revolving conditioning or tempering drum for wheat samples to be milled in the experimental mill. In the right foreground can be seen the wide spatula and colour board for testing the colour of flour by means of Pekar's Test. In the background to the left is shown the water absorption apparatus as in use, which gives the bread yielding capacity of flour.

SOIL MULCHING OR CULTIVATING EXPERIMENTS.

Geo. L. Sutton,
Director of Agriculture.

The object of these experiments is to determine how far and under what conditions the cultivation of winter-fallowed land is profitable during the spring and summer.

In these experiments three plots are used and, except as regards the number of times the different plots are cultivated after ploughing, all the operations connected with the preparation of the soil and planting the crop are the same for all plots, and this is that adopted for the main crop of the

The Uncultivated Plot.

farm, viz., ploughing to about four inches deep. The variety planted on all the plots at each farm is the same, the rate of seeding is about 45lbs., and the amount of superphosphate applied ranged from 70lbs. to 80lbs. per acre, until last year, when the quantity was increased to 80lbs. to 90lbs.

The treatment given to the different plots after the winter ploughing is as follows:—

Plot 1.—This is cultivated in spring, and again during the summer, after a fall of rain 25 points or over until seed time. In this way loose soil mulching has been continuously secured.

Plot 2.—The fallowed land is cultivated in spring, and not again during summer until just before seeding in the autumn.

Plot 3.—The fallowed land is cultivated in the autumn only, just prior to seeding.

The results obtained at the Chapman Farm in each year from the commencement of the experiment are as follow:—

SOIL MULCHING EXPERIMENT.

CHAPMAN EXPERIMENTAL FARM.

1914—1923.

Year.	HAY YIELDS.												GRAIN YIELDS.								
	1 Cultivated after ploughing, after rain, and prior to seeding.				2 Cultivated after ploughing and before seeding.				3 Cultivated only before seeding.				1 Cultivated after ploughing, after rain, and prior to seeding.			2 Cultivated after ploughing and before seeding.			3 Cultivated only before seeding.		
	C.	Q.	L.	%	C.	Q.	L.	%	C.	Q.	L.	%	bus.	lb.	%	bush.	lb.	%	bush.	lb.	%
1914	23	2	8	128	18	1	12	100	15	1	20	84	15	12	110	13	52	100	8	56	64
1915	15	1	4	100	15	0	24	100	15	0	0	99	9	28	93	10	13	100	10	35	104
1916	27	1	20	104	26	1	4	100	23	0	16	89	12	13	93	13	12	100	11	17	86
1917	26	2	16	106	25	0	8	100	11	1	20	46	11	33	149	7	44	100	6	35	85
1918	21	1	20	118	18	0	16	100	17	0	8	94	12	16	97	12	37	100	13	9	104
1919	39	0	0	97	40	1	4	100	33	0	8	82	22	13	100	22	11	100	18	37	84
1920	16	2	8	127	13	0	8	100	9	3	4	75	11	28	148	7	47	100	7	33	92
1921	19	1	12	114	17	0	0	100	14	1	12	85	14	42	109	13	31	100	13	36	101
1922	41	3	12	117	35	2	16	100	31	0	8	87	28	3	106	26	27	100	22	56	87
1923	18	1	20	84	21	3	20	100	21	0	0	96	16	11	86	18	45	100	17	49	95
A'age	24	3	23	108	23	0	11	100	19	0	16	83	15	20	105	14	37	100	13	7	90

The Cultivated Plot.
Cultivating Experiment, Chapman, 1917.

At the Chapman Farm the average results are consistently in favour of the cultivation after fallowing and before seeding, with a further slight advantage in favour of the cultivation after rain during the summer. The uncultivated plot also showed to considerable disadvantage in 1917, as may be seen from illustration (Fig. 1); this was due to the growth of weeds on the uncultivated plot, but which were controlled by cultivation on the other plots.

The results obtained at the Merredin Farm are as follow:—

SOIL MULCHING EXPERIMENT.

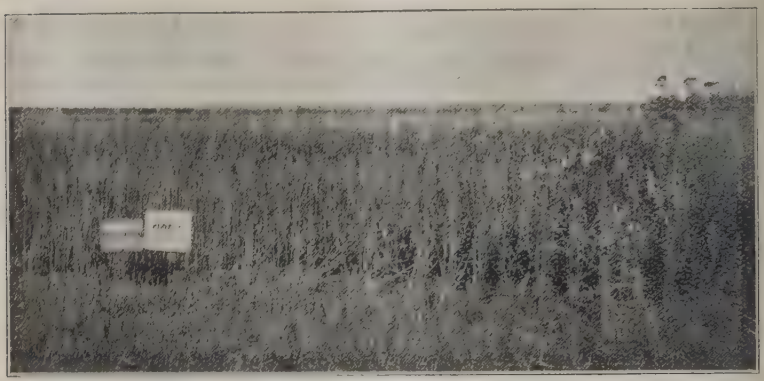
MERREDIN EXPERIMENTAL FARM.

1915—1923.

Year.	HAY YIELDS.										GRAIN YIELDS.									
	1 Cultivated after ploughing, after rain, and before seeding.				2 Cultivated after ploughing and just before seeding.				3 Cultivated only before seeding.				1 Cultivated after ploughing, after rain, and before seeding.			2 Cultivated after ploughing and just before seeding.			3 Cultivated only before seeding.		
	c.	q.	l.	%	c.	q.	l.	%	c.	q.	l.	%	bus.	lb.	%	bush.	lb.	%	bush.	lb.	%
1915	56	0	24	104	54	0	24	100	61	1	4	113	27	10	95	28	34	100	27	42	97
1916	56	2	0	118	47	2	24	100	48	2	24	102	12	0	109	11	1	100	12	51	117
1917	70	0	24	99	71	0	16	100	71	2	24	101	24	42	94	26	16	100	24	30	93
1918	54	0	0	103	52	1	4	100	55	2	8	106	29	33	105	28	16	100	24	16	86
1919	38	0	0	98	38	3	4	100	37	1	20	97	25	34	113	22	35	100	21	39	96
1921	52	1	4	98	53	1	12	100	48	0	24	90	15	12	84	18	11	100	15	33	86
1922	34	2	8	107	32	0	24	100	28	1	4	88	19	44	109	18	3	100	14	51	82
1923	51	0	0	103	49	3	4	100	47	3	12	96	28	40	100	28	40	100	29	17	102
A'age	51	2	8	103	49	3	21	100	49	3	15	100	22	51	101	22	43	100	21	17	94

Plot 1.

Cultivated in the Autumn after ploughing, after rain, during the Summer, and before seeding.



Plot 2.

Cultivated in the Autumn after ploughing and before seeding.

Plot 3.

Cultivated before seeding only. Note the presence of "Wild Oats" in this plot due to the lack of cultivation.

Cultivating Experiments, Merredin, 1919.

At the Merredin Farm the average yields are remarkably similar from all the plots, but slightly inconsistent as far as the hay yields are concerned, but for grain slightly in favour of the spring cultivation. One advantage of frequent cultivation is that the wild or black oat is destroyed; this point is brought out by the illustration of the crops growing on the different plots in 1919 (Fig. 2). It would appear from the absence of wild oat on the frequently cultivated plot, and its presence on the other two plots, and to a greater extent on the uncultivated plot, that the effect of the frequent cultivation is to put the ground in such tilth as to encourage the germination of the wild oat seed with light summer showers, thus enabling the resulting plant to be destroyed either by stock or by subsequent cultivation.

It is not to be expected that the presence of the wild oats would reduce the hay yield, but their presence is reflected in the grain crop as shown by the percentage of results of 113, 100, and 96 for the plots 1, 2, and 3 respectively.

In view of the results obtained at both farms and having due regard to the varied conditions connected with the cultivation of fallowed land in the W.A. wheat belt, it is recommended that the general practice should be to cultivate the fallowed land in the spring and again prior to seeding, and that, in cases where the ground is weedy, this cultivation be supplemented by additional cultivation during the summer.

WESTERN AUSTRALIA.

List of Country Shows for the Current Season.

Jennacubbin	Sept. 10	Wongan Hills	Oct. 2
Doodlakine	Sept. 10	Merredin	Oct. 2
Meckering	Sept. 12	Moora	Oct. 3
Dowerin	Sept. 17	Beverley	Oct. 3
Northampton ...	Sept. 17	Perth Royal	Oct. 7–11
Bruce Rock	Sept. 17	Kukerin	Oct. 13
Tammin	Sept. 19	Pingelly	Oct. 15
Goomalling	Sept. 19	Narrogin	Oct. 16–17
Greenough	Sept. 23	Nyabing	Oct. 18
Northam	Sept. 23–24	Wickepin	Oct. 21
Corrigin	Sept. 24	Harvey	Oct. 22
Irwin	Sept. 26	Toodyay	Oct. 22
Kellerberrin	Sept. 26	Wandering	Oct. 22
Quairading	Sept. 27	Wagin	Oct. 24
Nungarin	Sept. 27	Kelmscott	Oct. 25
Kulin	Sept. 27	Tambellup	Oct. 28
Lake Grace	Sept. 27	Katanning	Oct. 30–31
Geraldton	Sept. 30 & Oct. 1	Canning	Nov. 1
York	Oct. 1	Kojonup	Nov. 5
Harrismith	Oct. 1	Bunbury	Nov. 5–6

CULTIVATION OF THE POTATO.

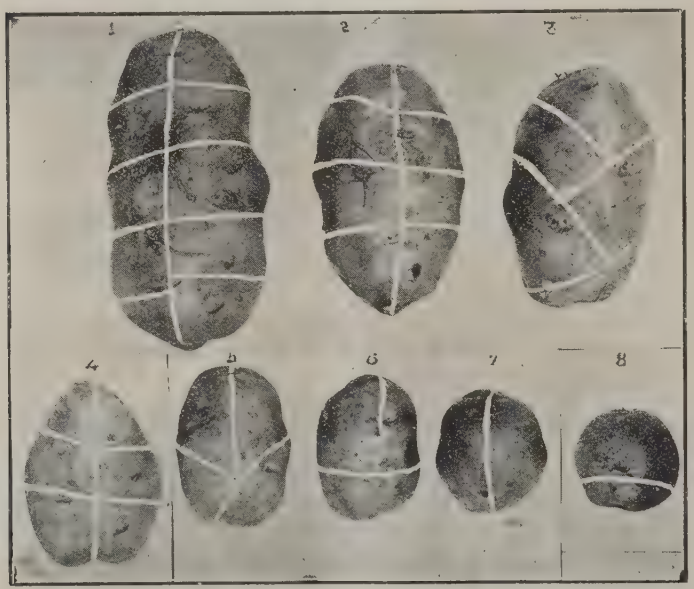
G. N. LOWE,
Senior Potato Inspector.

SEED. ITS SELECTION AND TREATMENT.

(*Continued.*)

There is very little difference in the value of a cut "set" and a whole one which come from the same high-producing strain, but strain is of the greatest importance.

For this reason, cut seed from a nicely graded shapely lot of tubers will invariably give better returns than a crop planted from small or "round" seed. In the case of the large potatoes it is reasonable to suppose, not knowing the strain, that the bulk of them at least was the product of roots that



Method of cutting tubers for seed. It is advisable to avoid seed such as No. 8, but if used the bottom portion or "heel" should be discarded.

yielded well, whilst in the case of the small tubers one can be quite satisfied that the greater proportion comes from poor plants.

No heavy crop has yet been dug from the "Delaware," at least where the tubers were all small.

Cutting the Seed.—Practically every grower has his own idea as to what is the correct method of cutting potatoes for planting. With the Delaware the eyes are so evenly distributed that it is possible to cut with a machine

designed for the purpose, but it is generally accepted that hand cutting, though slower, gives better results.

For this purpose a very old thin-bladed table knife, given an occasional rub up on the oil stone, will be found admirable. Butchers' knives or other heavy-bladed knives, besides being found awkward, cause splitting rather than a clean cut. Some growers are inclined to cut seed wastefully by leaving the "sets" too large. This is, of course, one direction in which the costs per acre for the crop may be very materially increased if proper attention be not given to it. Very often this operation is left to casual hands to carry out, with the result that instead of nice chubby "sets" of two ounces being cut, the weight is three or four ounces, with a consequently increased cost for seed.

With the "Delaware" one eye, as a general rule, represents a cluster of buds, and the inclusion of one eye will be sufficient.

It is a very wise provision of Nature that should one bud or sprout be injured that the next strongest takes up the running, though this injury will not occur to any extent except when seed already sprouted is used.

For this reason seed should not be allowed to develop long spindly shoots before planting, as a considerable portion of the strength and vitality of the potato is so used to no good purpose.

A good deal of argument occurs over the question of the productivity of the various eyes in a tuber cut for seed. It is noticeable that the extreme "crown" bud usually starts away first, and so it is often claimed that this gives a greater yield than any other. Experimental work has, however, shown that no such thing actually occurs.

The usual method employed for seed-cutting is to hold the potato and so operate on it with the knife. A much quicker way, however, is to have the knife stuck upright in a deal board on which the operator is seated, and to push the potato against the knife blade, allowing the cut portion to fall into the bag already conveniently suspended in front of it. With a sloping table arranged so as to have the seed continually rolling within the reach of the cutter, a considerable amount of time can be saved.

Opinions vary as to the correct time to cut the seed before planting, one contention being that after cutting, the freshly cut surface should be allowed to heal over. This is no doubt due to a false impression on the part of some growers that cut potatoes bleed if planted at once.

As the potato is largely composed of starch, a normal specimen will dry almost at once, and can be safely planted right away. Where, due to wet weather or other cause, it is decided not to plant immediately, the seed should be cut on to a floor and bagged as needed, as otherwise there is a risk of sweating.

The practice of dusting the cut seed with ashes or slaked lime followed by some growers has little to recommend it: caustic or fresh lime will cause damage if used.

The Depth of Planting.—This varies slightly with the season at which planting takes place. If, as in the hill crop at centres such as Benger, Roelands, and Burekup, where planting begins before the end of June, the best

A fine crop of "Delaware," grown at Roelands by Mr. R. A. Clarke, and which yielded at the rate of 10 tons per acre.

depth is found to be about 3½ inches. Later planting, however, should be at a depth of five inches to avoid the risk of sun scald and infection by Potato Moth. Good cultivation and hilling or moulding will also go a long way to reducing both these troubles.

The distance between the rows and the sets is also somewhat influenced by the time of planting. Naturally, an early planted crop is not so likely to suffer from lack of moisture as that planted late, so that early planted crops may be spaced about 28 inches between the rows and 15 inches between the sets. For the general planting the distances may be widened to 33 inches by 18 inches. Where there is an inclination to narrow planting, the fact must not be lost sight of that such crop is much more difficult for horse cultivation, and spraying is very much impeded, if not actually prevented.

For irrigated crops the distances can well be 36 inches by 18 inches to allow of successful watering and cultivation. The weight of seed per acre averages about half a ton, and the number of "sets" roughly 14,000.

SEASONAL NOTES.

Early plantings are now showing above ground, and provided the ground is not too wet the cultivator and the hoe must be kept going. Any potatoes still on hand should be picked over and disposed of before the sheets begin to reduce weight and attractiveness. Old potatoes are very slow of sale, but new washed lines are commanding high rates.

Grade your produce and then, if you are proud of it, plainly stencil your bags so that buyers will know with whom they are dealing.

Do not forget next season's paddock—fallow now.

CHICKEN REARING.

R. A. Dusting,
Poultry Adviser.

It is necessary to understand and bear in mind the fact that the care and attention devoted to the chick from hatching to three months old is the main factor in obtaining the highest egg production from a hen or flesh and size in table poultry. It is not enough to breed from high-producing stock or exhibition birds, and expect like to produce like unless the correct methods of rearing and feeding are followed to provide the constitution capable of standing the strain of heavy production or to build up the frame and size required in most show birds.

If the intention is to rear poultry in small numbers, up to 100 chicks per season, the natural method of brooding, if hens are procurable, is the best.

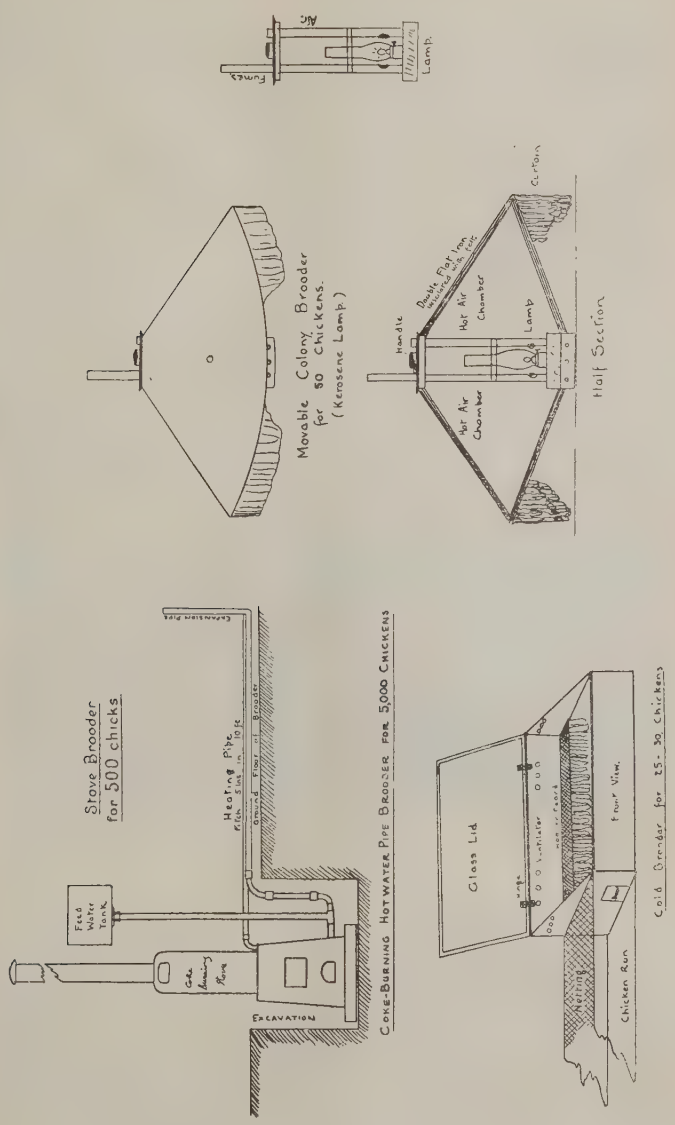
A moveable, floorless, rain and draught-proof coop 18in. by 18in., two feet high in front with slats for chicks to get in and out, placed on dry ground or an old bag covered with dry sand in a sheltered sunny position, on a grass run is the ideal place to rear healthy chicks.

In artificial brooding, warmth must be provided so that chicks can get it when they require, but they must not be compelled to stay in a heated atmosphere all the time. Sunshine warmth provides something not attained by artificial heat, also fresh air on the ground is unobtainable on boarded dirty floors. Free ventilation without draught, warmth with pure fresh air, exercise, and tender green food are things that must be provided to keep chicks healthy. The body temperature of poultry is higher than that of other farm animals. Their digestive system functions more rapidly, and oxygen being necessary to assist digestion of food, pure fresh air, free from lamp fumes, odour of droppings, or carbon-dioxide, should be supplied by proper ventilation. Impure air retards growth, saps the vitality, and is conducive to leg weakness, cold, roup, and other ills.

There are many styles of brooders, and top heat has been proved more successful than bottom heat. All corners in brooders should be rounded off to avoid crowding and suffocation or overheating. Allow chicks to remain in incubator until thoroughly dry, cool off by opening the incubator door about quarter of an inch. Remove to brooder early in the day so that chicks will get used to it before night. Have the brooder warmed up to 70 or 80 degrees before placing chicks in. Do not feed for 48 hours after hatching, as Nature has provided the food for this period. Cover the brooder floor with chaff or oat hulls and sand.

After years of experimenting with different methods of feeding chicks, the following has been found to be most successful:—Take 50lbs. prime wheat, 20lbs. hulled oats, 20lbs. yellow maize, 4lbs. beans or Tasmanian blue peas, 4lbs. canary seed, 1lb. hemp seed, 2lbs. charcoal. Put this through the corn-crusher and sift into three grades:—1, Pollard and brannings; 2, fine chick feed; 3, coarse chick feed.

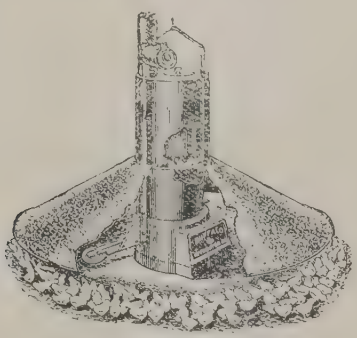
The first food given to chicks was No. 1, to which add finely cut tender lettuce, a little sand, and bread crumbs moistened with skim milk. Place this in shallow trough or saucer, sprinkling some on chick's back to attract



their attention. Let them clean this up and return them to brooder. One hour later repeat, always adding finely cut lettuce and milk, and watch that they do not stay out long enough to chill. Feed this for three days. No water was given for first or second days, but on third day sweet skim milk

should be given twice. After third day give No. 2, fine chick food, with fine shell grit in litter on brooder floor, and a shallow water vessel. Once water is supplied it must always be available fresh and clean. Until chicks were two weeks the No. 2 chick feed was supplied in quantities to keep them scratching and busy, with three feeds per day of No. 1, with little pollard and bran and always finely cut lettuce added, and moistened with milk. The lettuce and milk, with the charcoal in mixture, regulated the bowels and diarrhœa was unknown amongst the chicks. Commence hardening chicks by reducing temperature of brooder and give more ventilation. After 14 days the No. 3 mixture and larger shell grit were supplied in litter, and a run placed in front of brooder to allow them to run on grass patch, and lettuce hung clear of ground to pick at.

All the fresh air and sun possible was now given, but protection from wind provided around the runs. At this stage a little minced liver or lean meat should be added to the soft food once daily, and instead of lettuce finely cut grass or young sprouted oats, gradually feeding larger cracked oats, maize, and wheat. Chicks must always be returned to brooder before sundown to avoid chills. If brooder is getting crowded remove some of the larger ones to another compartment, or brooder. At four weeks old chicks should now have very little artificial heat, as the warmth of their bodies should be sufficient.



Stove heated Colony Brooder, for 500 chicks.

At six weeks put on whole wheat, hulled oats or skinless barley, and cracked maize, with soft food three times daily moistened with milk or meat gravy, with addition of finely crushed bone meal twice weekly to prevent leg weakness, and remove to clean fresh yards and warm houses, placing low roosts (six inches from ground) to encourage them to roost, thus avoiding overheating on floors. Round off corners of house to avoid over-crowding in corners until they take to roosts. Separate cockerels from pullets, and give the pullets all free range possible, feeding mash in morning, wheat and hulled oats at night, with fresh clean drinking water, grit, green food, and cleanliness of houses and freedom from insect pests, and the birds are fit to give the maximum production according to their capacity.

The brooders illustrated with this article are all successful if intelligently handled, but they will not run themselves. Over-heating is more disastrous than under-heating, but chills must be avoided. If good rearing is secured, success must follow.

COMMERCIAL POULTRY FARMS IN WESTERN AUSTRALIA.

R. A. Dusting,
Poultry Adviser.

Situated on North Lake Road, behind Applecross Wireless Station, are three egg farms that illustrate the possibilities of commercial poultry farming on a large scale. After leaving the Perth-Fremantle Road the first of these farms is "Yaldarra Poultry Farm" (owned by Mr. Aiken). The pro-

Front view of Hot Water Pipe Brooder, capacity 4,000 chicks, Mr. M. Love's Farm, Melville.

perty comprises 35 acres, and is laid out in large shady runs varying from a quarter to an acre in size. The breeds kept are White Leghorns and Black Orpingtons of the best laying strains, numbering 6,000 head, and Mr. Aiken intends increasing this number during the season. The incubators in use are Hearson's, Cyphers, Prairie, State, and Sentinel Electric machines. The brooder system used is the hot water pipe, stove heated brooder, and has been wholly constructed by Mr. Aiken, and is giving satisfaction.

Adjoining Mr. Aiken is Mr. M. Love's 40-acre egg farm. Mr. Love has been a successful commercial poultry farmer for a number of years, his six White Leghorns having won a laying competition in 1910, with the good record of 1,524 eggs in 12 months. The runs on this farm are large, and are constructed to carry 1,000 birds each. The incubators in use are lamp-heated hot air machines and one electrically-heated machine. Mr. Love

is experimenting with the latter with a view to converting all his incubators into electric machines. The stock carried are White Leghorns, Black Orpingtons, and Indian Runner ducks, numbering in all 8,000, which Mr. Love

End view of Brooding Yards, planted with young green rape, Mr. M. Love's Farm, Melville.

hopes to increase this season to 12,000. The brooders used are hot water pipe, and canopy hot air, stove-heated. The 4,000 chicks already hatched look fine and healthy.

A fine flock of Indian Runner Ducks, Mr. M. Love's Farm, Melville.

A quarter of a mile further on is Mr. R. Campbell's "Melville Poultry Farm." This poultry farm, started twelve years ago with little capital and 600 head of high-producing White Leghorns, to-day is a well laid out commercial proposition carrying 5,000 head of selected White Leghorns that are returning their enterprising owner a satisfactory income for the intelligent,

One of the yards, containing 1,000 layers, Mr. M. Love's Farm, Melville.

practical, and economical methods, combined with hard work which he has expended on them. Cleanliness, system, and labour-saving devices all go to make this farm the success it is. Mr. Campbell is also extending his accommodation to add 2,000 more of these egg machines to his flock. On all three farms ample green food is supplied by succulent lucerne and Berseem clover plots.

The photos. reproduced refer to Mr. M. Love's farm.

SALT FOR POULTRY.

R. A. Dusting,
Poultry Adviser.

Many persons are not aware of the risk they are taking in feeding an excess quantity of salt to fowls or ducks. The writer has investigated three cases of sudden death to a number of fowls in poultry yards during the past six weeks caused by salt poisoning, the using of water in which corned beef has been boiled to wet the mash being the main cause. Salt in small quantities, at rate of one teaspoonful to 50 fowls, is beneficial and makes the mash appetising, but excess quantity is poison. Death in some instances occurs within twelve hours. Indications of salt poisoning are excessive thirst, expansion of crop, frothing at mouth and eyes, dizziness, and diarrhœa. If only mild attack, olive oil relieves the irritation. Feed on bread and milk for a few days.

THE TRENCH OR PIT SILO.

G. K. BARON-HAY, B.Sc., Agric.,
Agricultural Adviser, Dairy Branch.

The climate of the greater portion of the South-West agricultural area of this State, resulting in our dry summer, more or less protracted, makes it imperative for all farmers to consider the question of the provision of fodders for the hand-feeding of stock during these summer months. For dairy cattle it is imperative that this conserved fodder should be of a succulent nature, so as to replace green fodder as far as possible. The only certain method of supplying this need is by the preservation in the green state of winter-grown crops to be used in the summer as silage.

Choosing the Site for the "Trench."—The site chosen should be elevated and well-drained, and as near the feeding troughs as practicable. A clay soil is preferable to a loamy one, but sandy soils should be avoided. In a sandy soil the seepage of water into the trench from the surrounding country would be considerable, and may act detrimentally on the silage. Should the drainage of the site not be good, a drain two feet deep should be dug round the trench after its completion, which will carry away surface water, and also the water which will flow from off the trench top itself, as when full of silage and covered with earth, the finished trench has the appearance of a mound.

Excavating the Trench.—Having chosen the site, the surface dimensions of the trench should be marked out by four corner pegs. The dimensions of the bottom of the trench should also be marked out, so that the slope at each end may be properly estimated. The area pegged out is now ploughed with a suitable plough, the single-furrow mould board being usually found the most convenient. The earth as it is ploughed may be scooped out with the ordinary dam-sinking scoop. The excavated earth should be placed on the sides of the trench, as it is necessary to leave the ends open for convenience in filling. A slope of one in three should be left at either end so that the horses can get in and out when excavating, and so that in filling the carts can be driven through the trench, which will assist in packing the material ensiled.

The sides of the trench should be kept as near vertical as possible, even if a little spade work is necessary. Having the sides vertical will minimise wastage, as the material can settle uniformly. When scooping out the trench it is advisable to scoop a little hollow at the end which it is intended to open first. This is to enable any drainage water that may get into the silo after it is opened, to collect in this hollow, and so not penetrate into the silage. (See diagram.)

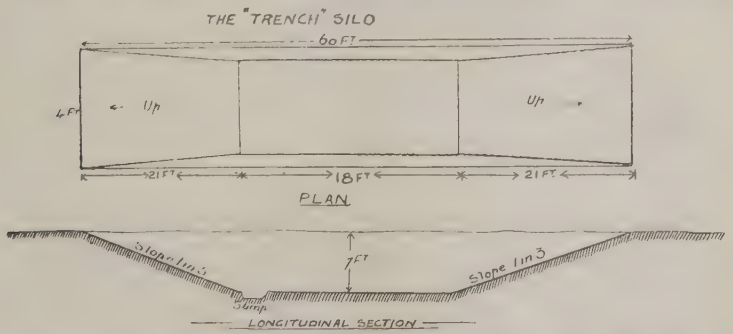
Size of the Trench.- It is not advisable to make a smaller trench than one to hold fifty tons of silage. A convenient size is one to hold eighty tons, and such a trench would require twenty acres of an oat and pea crop to supply the necessary material, taking an average yield of hay as one ton per acre.

The following table will give the dimensions of trenches to hold 80, 72, 64, and 56 tons of silage:—

	80 tons.	72 tons.	64 tons.	56 tons.
	feet.	feet.	feet.	feet.
Surface length	60	60	60	60
Breadth	20	18	16	14
Depth at centre of trench ..	7	7	7	7

In each case a slope of 1 in 3 is allowed at either end.

Crops to Grow.—Maize, in districts where it can be grown, is undoubtedly the most economical crop to grow for silage, because of the large yields obtained. Crops of maize not infrequently yield as high as 25 tons per acre of green material. Where maize is grown for silage it should be cut when the cob is well formed and the grain is in the doughy stage. It will be found



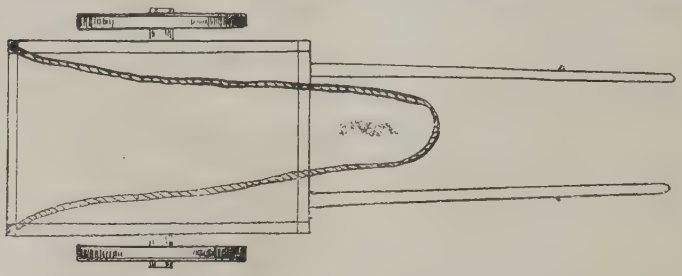
that at this stage the lower leaves are turning brown. Where maize can be grown, however, it is often possible to grow permanent pasture, and silage in such districts is to be looked upon as a wise insurance against a failure of this pasture, and of summer crops. In the greater portion of the State, where silage is most necessary, it is not practicable to grow maize, and resource must be had to the winter-grown cereal crops.

A mixture of oats and peas provides a suitable crop for ensilage. Sixty lbs. of Burt's Early or Lachlan oats with 40lbs. of White Field peas per acre is a suitable mixture to sow; the White Field pea being earlier than the Purple variety, and also a heavier yielder. A crop of oats alone, however, will make a good silage, if a mixed crop is not available. Wheat does not make such good silage as oats, as there is more fibre in the plants, and they are not so succulent as oats.

Cereal crops should be cut a little earlier than is usually done for hay, that is, when the grain is in the milk stage, and the straw just starting to change colour at its base.

In some portions of the State the spring growth of natural grasses and wild oats is considerable, and such material can be made into silage, and is best cut when the majority of the plants are in flower. If the grasses have harsh and fibrous stems at this stage, they should be cut before flowering, if necessary.

Filling the Trench.—The material to be put into the trench is usually cut with a binder, though a mower may be used. If the binder is used, and the material tied in sheaves, it is necessary to cut the bands before putting the material in the silo. This enables the material to be more firmly packed, and also facilitates the emptying of the silo. The twine, in itself, is undesirable, as unless well softened by the fermentation of the silage, may possibly cause an obstruction in the alimentary canals of animals fed on the silage. When filling, the carts may be driven into the trench before emptying; the trampling of the horses and the weight of the cart will assist to pack the material, an important point, as the making of good silage depends on the thorough exclusion of air, which can only be obtained by firm packing.



Showing rope in cart before commencing to load.

If the material to be ensiled is not bound into sheaves, the following will be found an easy and quick method of unloading the cart or waggon. The ends of a stout piece of rope are tied, one on each side, to the back of the vehicle. The rope should be long enough for the looped end to reach to the front of the cart and up round the load. This may also be used for tying down the load, if necessary. (See diagram.) Before starting to load, the rope is laid along the bottom of the cart and the material is piled on top of it.

To unload, the cart is driven into the trench and the looped end is attached to a stout peg driven into the side of the trench. The horses are driven along the trench, when the material is drawn off the cart. It is necessary to level the material in the trench and well trample it before depositing the next load.

When cutting the crop it is advisable to cut only as much crop as will be loaded into the silo that day, as remaining some hours in the open will cause a lot of the moisture to be lost from the material.

The trench should be filled until about three feet above the level of the surrounding ground, making the centre slope off towards the sides of the trench. When the filling of the trench is completed, earth is scooped back on the material, until a layer of earth of about 18 inches thick covers the whole area of the trench. If thought desirable, the material may be covered with chaff bags before scooping on the earth, though it is doubtful if the little material saved is worth the sacks used to save it. The green material, under the considerable pressure of the earth, will sink some 18 inches to two feet, and in the process of sinking cracks may appear in the covering of earth. If any such cracks do appear they should be filled in immediately or wastage may occur at these points, due to the admission of air. With a trench such as has been described there will be very little waste, and if not required, the silage will keep almost indefinitely.

EXPORT OF FRUIT FROM WESTERN AUSTRALIA IN 1924.

Geo. W. Wickens,
Officer in Charge, Fruit Industry.

The success or failure of the Fruit Industry in this State, far more than in the Eastern States where big centres of population and processing factories give rise to widely differing conditions, is bound up in our ability to place our product on over-seas markets at payable prices. Three-fourths of the area under fruit in Western Australia is devoted to growing kinds, viz., apples, oranges, and grapes, which can be successfully exported, the last-named being sent away both as fresh and dried fruit.

Taking the season as a whole apple-growers have been fairly successful, both at home and abroad, for although prices in both the markets mentioned have been low at times the average price for the season has been distinctly payable. One factor that helped considerably was the competition amongst buyers desiring to purchase lines for shipment. Eastern States as well as local firms were operating, and mid-season varieties suitable for shipment were bought at 7s. 6d. and 8s. per case on growers' sidings: so far as I can judge from returns to hand the average London price for the season will be 14s.

For the half-year ended 30th June, 1924, 248,411 bushels of apples were shipped overseas, the English market absorbing the major portion, and this year's experience has shown that apple-growers in Western Australia must revise their ideas as to the best time of the year to export, and the varieties most likely to bring good prices. In former seasons the early boats have been the most favoured, and the aim for a number of years past has been to secure an apple equalling the Jonathan in flavour and colour, but ripening some weeks earlier, so that the usual time of commencing export operations might be the first week in February instead of the last week in that month, and one of the advantages which apple-growers in this State were thought to possess over those in the Eastern States was the geographical position which enabled them to place mature fruit on the London market at an earlier date; but the last two years have shown that it is not always the fruit on the early boats which realises the best average price.

The first boat with fruit from Western Australia left Fremantle on the 21st February, and the apples were sold in London during the first week in April, realising from 10s. to 18s., with a few Cox's as high as 30s.

The next boat taking apples left on the 29th February, and these brought good prices all round, realising from 13s. 6d. to 20s.

From the 3rd March to the 29th March nine boats left Western Australia taking apples to the English markets, and prices were moderate throughout, ranging mostly from 12s. to 15s. with a few as low as 9s.

During April three boats carried apples from this State to England, and there was a distinct rise in the average price, the fruit realising mostly from 13s. 6d. to 18s.

The apple export season so far as English markets are concerned finished in May, two boats taking consignments from Fremantle during that month, the returns for these showed a further substantial increase. "Yates" sold in London in July, realising 24s. per case, "Rokewoods" 23s., Cleo.'s" 21s., "Dunn's" 20s., and "Statesmen" 18s. to 24s.

It is only in very recent years that apples have been shipped from Western Australia to London in May, and though "Rokewoods" have been sent in April for several years past, and "Statesmen" occasionally, I do not remember "Yates" figuring before in our list of varieties exported to England. As a variety for sending to Java and Singapore it has long been a favourite, consignments going forward to these places as late as November; but for the English market it was looked upon as one which would arrive when English fruits were in season, and consequently bring low prices. Apparently, however, there is a good market for our late apples in England during the months of June and early July, when the competition with American apples, which our fruit meets with in April and May, no longer obtains.

Orange-growers received such poor returns from last year's export to London that the quantity going forward this year will be very much less. The first boat to take oranges left on 3rd July with only 5,018 cases on board, and the second on 26th July with 3,269 cases. At time of writing no information as to the condition of fruit on arrival nor prices obtained is available, but from personal observation of the fruit sent forward for shipment, I am convinced that some of our growers do not sufficiently realise how necessary it is to handle in the most careful way possible oranges intended for export: at least, if the growers themselves are aware of this necessity then they have failed to imbue their employees with the same knowledge. Out of the two small shipments in July some hundreds of cases were turned down, and rightly so, at the Port of Fremantle, on account of decayed and mouldy oranges showing amongst good fruit in the cases. So far as the Pathologist of this Department and myself could trace, the decay in nearly every instance had commenced at a spot where the fruit had been bruised in picking or packing, or where marked fruit which should have been rejected had been placed in the case: or, again, in some instances where in nailing up, the nails had been driven into the fruit. Growers are apt to think that oranges, with their comparatively thick coverings, are much less likely to suffer from bruising than apples, but a bruised apple will remain without rotting far longer than a bruised orange, and a further disadvantage with the latter is that the bruise is not easily detected.

An interesting experiment is being made this year, some of the fruit, before being packed, having been dipped in a solution of bluestone, and I have arranged with Dr. E. J. Butler, Director of the Imperial Bureau of Mycology, Surrey, England, to examine the dipped and undipped fruit on its arrival in England, and furnish me with a full report on the general condition of the shipment.

I have also kept in cold store here two cases, one dipped and the other undipped, out of each consignment, and these I shall examine from time to time. I may state I examined the lot kept out of the first consignment four weeks after being placed in store, and found them in splendid order.

Grape-growers have not had a good time this year owing to the fall in prices of dried fruits on the London market, Lexias slumping badly, and sultanas realising about half the price obtainable three years ago: currants being the only line quoted at rates approximating those of previous seasons. The sale of table grapes on the local market was taken in hand by a majority of growers in the Swan and Spearwood districts uniting to fix a minimum price for their fruit at the auction marts, and though all the benefits hoped for did not accrue, there is no doubt a measure of success was met with, and the co-operative selling movement which has been initiated will gather strength in future seasons.

Growers who exported table grapes to London have had fairly successful results. In the majority of instances the grapes have arrived in good condition, and when this occurred good prices were realised. Wasty fruit was sold as low as 4s. and sound fruit as high as 37s. per case. A number of consignments brought from 18s. to 30s. per case, and I think the average price, London, for the season will be about 20s.: as the cases used were ¾ bushels containing less than 30lbs. of fruit, this price is very satisfactory.

The pear crop was much lighter this year than last, and there was a big falling off in the number of cases exported, this year's total being 7,162 cases as against 15,280 cases last year. Prices varied according to variety and condition of fruit at time of landing, some wasty consignments realising as low as 2s. 9d. per half-case, while some choice sorts in good condition went to high figures. I know of one lot of "Josephines," 54 cases (¾ bushels), which brought from 28s. to 38s. per case, the grower receiving a cheque for £68 19s. net return for his fruit on railway siding.

I was shown this week an extract from a private letter written on 6th May by Captain L. Craig, Agricultural representative of Western Australia at the Wembley Exhibition which is distinctly interesting. It is as follows:—

> "The apples being sold in the Pavilion are nearly all West Australian, and they are opening up much better than those from other States. Mr. Nelson's from Balingup were the best being sold yesterday. Barrett Lennard's grapes, too, are in splendid order, and selling like hot cakes at 3s. per lb."

I append particulars hereunder showing number of cases shipped for the period 1st January to 5th August, 1924. It will be seen that many other markets are tried in addition to London, but the last-named is our principal outlet.

EXPORT OF FRESH FRUIT FROM WESTERN AUSTRALIA FOR PERIOD 1ST JANUARY TO 5TH AUGUST, 1924.

Destination.	Apples.	Grapes.	Pears.	Plums.	Peaches.	Apricots.	Nectarines.	Passion.	Quinces.	Persimmons.	Oranges.	Loquats.	Lemons.	Total.
	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.
London ...	184,649	16,345	6,450	9½	5	...	...	2	7	19	8,108	...	...	215,594½
Hull	25,251	...	388	...	...	...	...	...	...	...	...	...	...	25,639
Liverpool ...	821	...	...	...	...	...	...	...	...	...	..	...	...	821
Manchester ...	12,073	...	5	...	...	...	...	...	...	...			..	12,078
Hong Kong	100	25	...	...	...	...	...	...	...	...	...	...	...	125
Shanghai ...	25	25	...	...	...	...	...	...	...	...	...	...	...	50
Batavia ...	4,288	1,017	124	...	...	2	...	...	...	...	1,640	...	75	7,146
Sourabaya ...	4,653	1,848	43	1½	3	10	2	...	...	...	152	...	5	6,717½
Samarang ...	1,212	976	53	...	...	...	...	...	...	...	...	...	...	2,241
Singapore ...	10,667	3,525	15	9	3	...	...	...	10	...	1,054	...	5	15,288
Bombay ...	2,714	...	...	...	...	...	...	...	...	...	...	...	...	2,714
Colombo ...	3,468	679	...	...	...	...	...	...	...	...	35	...	...	4,182
Port Said ...	2,100	25	...	...	...	...	...	...	...	...	...	...		2,125
Durban ...	1,994	200	...	...	...	...	...	...	...	...	...	...	...	2,194
Alexandria ...	200	...	...	...	...	...	...	...	...	...	..	...	...	200
Calcutta ...	135	...	...	...	...	...	...	...	...	...	...	...	...	135
Mauritius ...	50	...	...	...	...	...	...	...	...	...	...	...	...	50
Beyrouth ...	302	...	...	...	...	...	...	...	...	...	...	...	...	302
Capetown ...	1,375	...	...	...	...	...	...	...	...	...	...	...	...	1,375
Totals ...	256,077	24,665	7,078	20	11	12	2	2	17	19	10,989	...	85	298,977

THE VALUE OF SHEEP CLASSING BEFORE SHEARING.

H. McCallum,
Sheep and Wool Inspector.

The classing of sheep is one of the most important branches of the sheep-breeding industry, and requires a good deal of knowledge on the part of the classer. At the time of classing a farmer on going through his flock will find, even with a small flock, a number of different types. A farmer ought to know the productive capacity of his holding and to what extent its productiveness is influenced by environment and climatic and soil influences.

The farmer's objective should be to produce a better class of sheep carrying the best commercial wool possible, and more of it, every year. This result can only be obtained by constant culling of the flock. The average sheep farmer can, however, with a little judgment, class his own sheep. It is every woolgrower's duty to class his sheep before shearing, and to cull his young sheep, so that in time to come he may possess a flock which is even and as near perfection as possible. If the flock is not culled, the undesirable units will retard its improvement. The sheep will soon deteriorate, and in time carry little wool. Some farmers contend it is unnecessary to cull the faulty sheep, but it is certainly most profitable for every sheep owner to cull. This particular work will more than repay him by the bigger returns per head for wool, and he will have a flock of sheep of strong constitution and large frame. The main object of classing is to reject any faulty sheep, or those of a type other than the sheep the farmer wishes to breed. The percentage of culls to be taken out will greatly depend upon the standard set of the flock. In some flocks the number of culls will be decided by the number of sheep the farmer can afford to dispose of. Every year, as the flock improves, the percentage of undesirable sheep will be lower, and it follows that the standard of the culls improves and the evenness of the flock becomes one of its most noticeable and satisfactory features.

Sheep having any of the following defects should be taken from the flock:—weak constitution, small, undersized, narrow-chested, long-legged, frames not in proportion, all deformed sheep; also those having kempy hairs, and all sheep whose wool runs very coarse at the breech. Sheep that are covered with wrinkles over the body, and all very short-woolled and open-wooled backed sheep lacking density or growing a dull yellow-coloured fleece, carrying an excessive amount of yolk, or cross-fibred wool, which is of low value should be discarded.

In classing the old sheep sound judgment should be exercised. Every farmer will have some of his aged ewes to sell yearly, the young ewes taking their place. The unprofitable sheep and those which have outlived their usefulness and do not compare with the best ewes of the flock should be disposed of. Aim for perfection and type.

This State can grow fine, medium, and strong wools of the highest class. Avoid any class of wool that is rough and harsh; grow a wool that is soft to handle and infuse as much quality and character into it as possible by

good breeding. The improvement of a flock by means of breeding requires constant care, and the qualities of both ram and ewes must be considered. In the majority of cases the influence of the ram is more likely to be impressed on the offspring than those of the ewe. Breed only from the very best of both sexes—the flock must be kept up to its normal size. The best animals should be selected until in course of time the flock will consist of high-grade sheep only. Until this work is accomplished it will not be wise to make use of sires bred by yourself. It is strongly recommended that the purchase of superior sires be made from older established flocks bred in many parts of Western Australia.

All possible attention should be paid to the little details so necessary, as they are the things that count, such as straightness of the back, depth through from shoulder to shoulder, well sprung ribs, and good growth of bone. These are points that cannot be disputed. If the farmers did more classing of their sheep it would obviate a good deal of extra work and time lost when classing the clip at shearing time.

There is no need for the average sheep owner to purchase the rams or ewes from the Eastern States; these sheep can be obtained from our local stud breeders in the Great Southern, the Midland, and Geraldton districts. The sheep from these studs compare favourably with the sheep bred in Eastern Australia, and by purchasing locally the farmer can inspect the animals.

The improvement that has taken place in the flocks of Western Australia during the last few years is the result of thorough and systematic sheep classing. Western Australia has to-day flocks equal to any in Australia, and the unrivalled position it holds for producing wool of high value has only been achieved by the purchase of the best stock possible by the stud breeders and sheep classing. Our progress in sheep breeding has been recognised, when it is remembered that Eastern States breeders have purchased our rams for their flocks.

THE TUART BUD WEEVIL.

(Haplonyx tibialis.)

L. J. Newman, F.E.S., Entomologist, and
J. Clark, F.L.S., Assistant Entomologist.

This insect, as its name implies, attacks the flower buds of the Tuart (*Eucalyptus gomphocephala*). The Tuart is one of our most useful hardwoods, and any insect that interferes with its seeding powers must be regarded as a serious pest. For many years it has been observed that the immature flowers of this species of Eucalyptus have been annually falling. This shedding takes place mainly between the months of November to April. During this period large numbers of terminal twigs with buds attached cover the ground around the base of the trees. Some of the old settlers in the Tuart areas declare that this falling has been going on to their knowledge for the past 40 to 50 years.

From the appearance of the severed portion there was no doubt that it was done by an insect. Up to this period we had no knowledge of any insect with such habits existing in Western Australia, excepting the larvæ of various case moths, which cut off twigs, etc., to form their cases. The manner of cutting seemed to indicate that it had been done by some moth larvæ or caterpillar, and that the larvæ found in the fallen flower buds was that of one of the various beetles found in decaying vegetable matter. By the time the larvæ have developed sufficiently to be observed in the buds, these vessels have become somewhat decayed and softened.

To determine the causative factor a careful investigation, both in field and laboratory, was undertaken in May, 1921. This work entailed the gathering of large quantities of these fallen flower buds, and the placing of same with moistened sand in observation cages. Many of the buds were closely examined by cutting and sectioning. Continuous observations were made in the field amongst the Tuart trees.

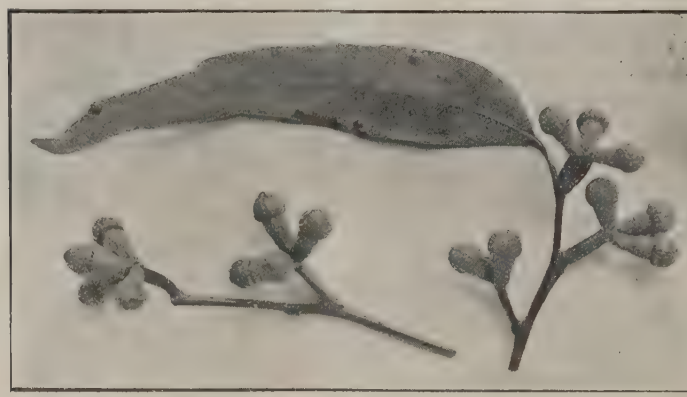
Early in September, 1921, we were rewarded by the discovery of the culprit in the act of cutting off the twigs containing the buds. This proved to be a small weevil belonging to the Genus Haplonyx. The material in the observation cages yielded no results until the latter end of September. On the 25th of September several beetles were noted in the cages. These were captured and examined, and proved to be identical with the weevil found in the field. This then proved that the larvæ found in the fallen buds was the immature stage of the weevil causing the damage. Up to this point we definitely defined the larvæ and imago or adult.

Further observations in the field were continued, resulting in the discovery that before cutting off the twigs containing the flower buds, this weevil cut a small hole in the cap of the unopened bud and deposited its egg therein. Having thus laid in several buds, it deliberately returns along the twig and cuts off or rings same. The twig may fall during the act, or it may hang on for some time until wind or other agencies cause it to fall. In the development of this weevil larva, it appears to be necessary that the buds

should fall to the ground. When in contact with the soil they soften, and thus make the bud tissue easily available to the grub inside.

The attack of this weevil is not entirely confined to the flower buds of the Tuart. It has also been found in a lesser degree attacking the flower buds of the Red Flowering Gum (*Eucalyptus ficifolia*) in the Denmark district.

Life History.—The female weevil drills a hole in the capsule of the flower bud, depositing a single egg. After egg deposition she at once fills the hole containing the egg with some of the material previously bored out. In some instances she was observed to lay one egg into each of the flower buds on the stalk before cutting off. In other instances it was noted that after having laid one egg, the whole cluster of several buds would be cut off. Again it was also noted that the hole was bored and no eggs laid, yet the twigs were rung or cut off. As if for sheer devilment, this weevil has been seen to deliberately cut off twigs containing flower buds without having bored or deposited a single egg.



Typical twig containing flower buds as cut off by weevil.

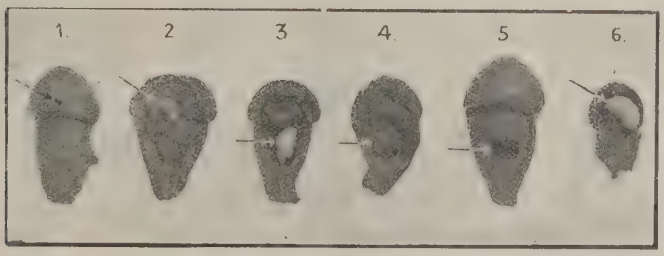
The Egg. This is an extremely delicate whitish, elongate-ovate object, slightly under 1 m.m. in length. It hatches in from eight to 12 days in the fallen flower buds.

The Larva or Grub.—When hatched from the egg is very tiny, white, legless, with small brownish head and good jaws. It feeds in the top portion of the bud just under the capsule until nearly full grown. As the larva grows it assumes the typical weevil appearance, and remains in a curled-up attitude in the flower bud as it is depicted in illustration. (Fig. 2.)

Pupa.—Before assuming the pupa stage the larva, which is now about four months old, bores its way to the basal portion of the bud and therein pupates. The pupa is naked, white and very active when disturbed. See

illustration. (Fig. 3.) The pupation period lasts for one month, when the adult or imago cuts its way out of the flower bud base. See illustration. (Figs. 4 and 5.)

The Imago or Adult.—This is a small weevil about ¼in. long and 3/16ths inch broad. It is provided with a long stout rostrum or snout half as long as the body. The legs are strong and powerful, the front pair being twice



1. Hole made in capsule of bud, wherein egg is deposited. 2. Typical larva within flower bud. 3. Pupa in base of flower bud. 4. Adult weevil just before emerging. 5. Hole cut in base of flower bud by escaping weevil. 6. Cocoon of Braconid parasite within bud.

as long and stout as the second and hind pairs. All the legs are provided with greatly dilated tarsi or feet. The enormous front legs are provided to encircle the twig whilst the cutting off process is in operation. The colour of the adult is brownish, with two lighter bars across the front part of the wing covers and a light small patch on the middle, behind. The male is considerably smaller than the female, and both have good powers of flight.

1. Various stages of the weevil larva. 2. Pupa. 3. Male and female weevils.

The adults and all other stages may be found at all seasons of the year, but as before stated they are more active and destructive between the months of November to April.

Parasites.—So far no really active parasites have been noted, the only one of importance being a species of Braconid wasp belonging to the Genus *Iphiaulax*. This parasite, unfortunately, is not numerous enough to make

any marked reduction of the weevil. By the use of her long ovipositor she reaches the body of the developing weevil larva within the flower bud and deposits an egg in same. This egg gives rise to a small maggot, which feeds upon its host, finally destroying it before the pupa stage is reached, spinning its cocoon in cavity made by weevil larva. (Illustration F. 2, No. 6.) Instead, therefore, of a weevil issuing we have the parasitic wasp. (Illustration.)

Braconid Wasps, male and female, parasitic on larva of weevil.

Methods of Control.—Owing to the protected life of this weevil within the flower bud and the large area of country over which it is found, artificial control is rendered difficult and costly, if at all possible. We shall have to depend upon nature asserting herself and producing every few years an abnormal crop of flower buds in excess of the weevil requirements, such as has happened during the past season. Every effort must therefore be made to collect during such seasons as much of the seed as possible.

The weevil does no serious damage to the trees, confining its attack to the flower buds. Therefore, if the before-mentioned effort to collect the seeds in the good seasons is made, the loss of seed by this pest for some years can be largely made up.

PUMPKINS AND MELONS.

H. D. Larwood,
Inspector of Potatoes.

Pumpkin.—This market commodity is much in demand. Values at the markets usually range from £6 to £12 per ton wholesale. An ordinary crop produces from six tons upwards per acre. The plant is heat-loving, and requires a certain amount of moisture. In this State there are three classes of pumpkin in general use—Ironbark, Bugle, and Turk's Cap. Of the Ironbark class there are several varieties which do well, viz., Triamble, Crown, and Nugget for market, and the Giant varieties for stock purposes. The Bugle or Trombone species are noted for their heavy cropping. The Turk's Cap is of value as an early pumpkin for market or for stock, and is a heavy bearer.

The soil will need to be of good tilth as for all garden crops, well-drained, and of adequate moisture. Should the land be very moist, plough into lands three yards wide and plant the seeds on the crown of the land. Care must be exercised not to cover the seed too deeply, but plant in moisture, and cover enough to prevent quick drying. Plant the seeds in groups of four or five, several inches apart, with the groups about eight feet apart. The plant is very tender, is easily destroyed by frost, and the seed is apt to perish in the soil. Do not plant the seed unless the soil is warm, but be sure there is sufficient moisture to ensure germination of the seeds. The pumpkin needs a sufficient moisture supply, and must be irrigated on light dry soils. With enough food and moisture the plant will revel in the heat and record a large production. Avoid excessive watering, as the land will become water-logged. The heaviest crops are produced on rich, well-drained, and moisture retentive soils. Light soil, if abundantly rich in plant food and adequately moist, will produce satisfactory crops. Stockyard or stable manure broadcasted is an excellent fertiliser, but failing this sow artificial manure broadcast or, as is done by many successful gardeners, by sowing the manure along two or three furrows every three yards when ploughing the land. Plant the seed on the surface of these manured furrows after the land has been thoroughly harrowed. The distance for seed planting is somewhat dependent on the varieties to be planted, but as a general rule a hill of seeds every eight or nine feet square will meet the majority of requirements. After the seeds are up and the second leaves are showing, thin out the plants in the hills, leaving two or three only of the strongest. Plant seed when all danger from frost is over, usually from September to December.

Varieties: *Turk's Cap.*—A distinct type of pumpkin, well-known for its peculiar shape, for which it has received the name of Turk's Cap or Turban pumpkin. The fruits vary from six to 20 lbs. in weight, the cap, usually lined with green and white stripes, being somewhat hemispherical, and containing four or five deep ribs. The colour varies from light red to a dark green. The flesh is of an orange colour and is thick, floury, and sweet.

Ironbark.—This class is well-known for its keeping varieties, and has as a rule a very hard rind. The varieties vary in colour from light blue to a very dark green.

The *Triamble* is a flattish ribbed variety, with three raised ridges on the crown surface (a very desirable kind, fair cropper, and excellent keeper). The *Nugget* and *Crown* varieties are flattish ribbed, of a dark greenish blue colour, and excellent keepers, both being heavy croppers and of uniform size. Do not aim at producing very large pumpkins for market; endeavour to raise medium-sized—six to 10 lbs. in weight—with good solid flesh. Do not save seeds from large hollow kinds commonly known as windbags, but select from solid, thick, fleshy fruit, with only a small seed bag. See that the rind is hard and not susceptible to bruising.

Bugle or *Trombone.*—These are very heavy croppers, and of tremendous weight. Long like a bugle or trombone, and orange in colour.

Manuring.—Use as much stable manure as is available, and supplement with artificial manure dressing along the furrows of the rows proposed to plant. Blood and bone manure, 448lbs.; superphosphate, 560lbs.; sulphate of potash, 112lbs.; apply at the rate of three to four cwt. per acre.

Cultivation.—Keep the hoe and scarifier going until the plants have grown enough to prevent cultivating.

VEGETABLE MARROWS.

Prepare land and manure same as for pumpkins, but plant much closer —five feet being ample between the rows and hills of plants. The bush marrow is ready for use in about nine weeks; pumpkins usually take 12 to 14 weeks.

Varieties: *Long White Bush.*—A very quick growing variety, attaining a length of from 18 inches to two feet six inches—creamy colour and a good keeper.

Long Yellow.—A running variety, heavy cropper, and a good keeper; not as early as the White Bush, but more compact in shape; a very dark cream colour.

MELONS.

The Water and Rock melons are very refreshing fruits, and ripen at a time when the summer it at its height. Prepare land same as for pumpkin. Water melons show a marked liking for newly broken-up land. Both will grow in almost any land, providing sufficient moisture and plant food is available. Prepare and manure land same as for pumpkins. Plant seeds when danger of frost is over or raise seeds for early planting in pots under glass.

Varieties: *Water Melons.*—Tom Watson—the most popular variety here —dark green in colour, oblong in shape, thin strong rind. A good carrier and of delightful flavour and rich colour. Excellent cropper.

Cuban Queen, an old favourite, somewhat spherical in shape, marked alternately with bands of light and dark green, flesh bright red, a good carrier.

Black Spanish, large rounded with slightly marked ribs, skin nearly black, a hardy and productive kind.

Other well-known varieites are Mammoth Santiago, Ice Cream, Rattlesnake, and Florida Favourite.

Rock or *Musk Melons.*—Early Hackensack, large size, productive and excellent flavour.

Large Nutmeg, most popular sort, netted skin, thick flesh, solid dark green with delicate nutty flavour.

Cantaloupe, fruit large and heavy, splendid carrier, flesh orange red, juicy, and of good flavour.

Other varieties grown by gardeners—Green Fleshed Cantaloupe, Golden Perfection, Nutmeg, Cavaillon, and Emerald Gem.

Plant hills of rock melons same as vegetable marrows, about five feet square, or in trenches as for cucumbers.

CUCUMBER.

A native of the East Indies, and is grown extensively in almost all parts of the world. It is a very hardy vine, the seed retains its germinating power for periods up to ten years. The plant is a most prolific bearer, and revels in heat and moisture but will not withstand frost. A rich soil, well-drained, and retaining the moisture will be found to meet the requirements of the plant. Highly satisfactory results have been obtained from land which has previously been planted with a root crop. A light soil which warms up early is of a decided advantage for early cucumbers. Early plants are usually raised under glass in pots or tins and transplanted. Planting out should not be done until the soil becomes warm and danger from frost is over. The seeds may be planted in hills, but the method usually adopted here is to dig out a fairly good-sized trench, about a foot wide and a foot deep, and enrich with well-rotted manure. Work the soil and manure thoroughly together, and place plants about 18 inches apart. Make the trenches four to six feet apart. Rock melons are also very successfully grown by this method. If planting in hills method plant five or six seeds in each hill, and when several inches high thin out to three plants, leaving only the strongest. Make the hills about five feet apart. For late planting, viz., January, February, select only very moist situations.

Fruit should be ready for use from six to eight weeks from planting. Gather before the fruit shows a yellowish tinge.

Varieties: *Long Green Prickly.*—An old standard variety, dark green, firm, crisp, a tremendous bearer.

White Spine.—Good size, straight and symmetrical, holds green colour well, very productive and early.

GARDEN NOTES.

October.—The sandy soils will need irrigation now if gardening is to be proceeded with.

Sow.—Turnips, Beet, Parsnips, Carrots, Cabbage, Tomatoes, French Beans, Celery (Henderson's White Plume and Golden Self Blanching), Pumpkins, Water Melons, Rock or Musk Melons, Vegetable Marrows, Cucumber, Leeks, Peas (only where ample water can be applied, William Hurst, American Wonder), Egg Plant (New York Improved Purple, Early Long Purple and Black Pekin), Sweet Corn (Country Gentleman, Silver Mine and Early Cory), Kohlrabi (Purple and Green), Sweet Potato (Large Red and White Maltest), Lettuce, Radish, Parsley, Herbs.

November.—Same as October.

December.—Same as October, also make first sowings of Cauliflowers, viz., Early Expert, Snowball, White Queen, Early London, Aphis Proof or Greasy Leaf. Use abundance of mulch to retain moisture in soil.

HORTICULTURAL AND VITICULTURAL NOTES.

Geo. W. Wickens,
Officer in Charge Fruit Industry.

SEASONABLE WORK FOR OCTOBER, NOVEMBER, AND DECEMBER.

October.—Cultivation in the orchards and vineyards needs every attention this month. Ploughing and cross-ploughing will have been completed in September, and the cultivator must be kept going unless prevented by rain. Should rain occur the cultivator should be used again as soon afterwards as the land is dry enough to work without becoming sticky. The winter rainfall of 1924 has been under the average, and every care must be taken to keep the top soil from four to six inches in depth in a thorough state of tilth throughout the summer so that as much as possible of the moisture contained in the subsoil may be retained.

The land around the trees which cannot be reached with the cultivator or other horse-drawn implements must be freed from weeds and loosened with a digging fork or pronged hoe.

Young trees in newly-planted orchards require special attention, and hoeing should be lightly done so as not to disturb the roots which are now making new growth.

Apple-growers in Western Australia are fortunate in being free from the necessity of carrying out spraying operations this month against Codlin Moth and Scab, which claim so much attention in other States of the Commonwealth, but though our orchards are not affected with the insect pest or fungus named, we are not immune from pests and diseases which require treatment. Apple-growers must see that Woolly Aphis receives attention during this month and next, for when the rigour of winter is past and the high temperatures of mid-summer have not been reached, the climatic conditions are ideal for the pest's increase. Black leaf 40, 1lb. with 3lbs. of soap dissolved in 80 gallons of water, is a good spray for this time of the year.

Powdery mildew of the apple requires attention, and should be treated with atomic sulphur, using 1lb. in 10 gallons of water as soon as petals have fallen.

Pear trees in districts where Pear Scab is in evidence must be treated, using Bordeaux mixture 6-4-50. As advised in the last issue of the *Journal*, the essential time of application is at the pinking stage of blooming; some varieties reached that stage last month, and some will this month. Repeat the spray at the same strength when the young fruits have formed, and in bad cases a third spray should be applied a fortnight after the second, using lime sulphur at a strength of one gallon in 40 gallons of water.

Where grape vines have been well treated in August and September for Anthracnose, the disease will probably not require any further attention this month, but should weather conditions be such as to favour its occurrence, Bordeaux mixture, at the ordinary strength of 6-4-50, should be applied.

Sulphuring should be carried out for the control of Oidium when the shoots have reached two or three inches in length.

Spray orange and lemon trees with Black Leaf 40 to control Orange Aphis.

That arch enemy of the fruitgrower of Western Australia—Fruit Fly—will be feeling the genial effects of spring, and baiting early ripening stone fruits must be commenced before the end of this month, and regularly continued both on these and on orange trees. No fallen fruit should be allowed to lie on the ground for more than 24 hours in orchards where the fly is present, and all infested fruit should be destroyed as soon as it is discovered whether amongst the fallen or picked fruits.

Use Paris Green bait for cutworms in vineyards and young orchards, but be careful not to allow this bait to touch the stems of vines or trees.

NOVEMBER.

Continue cultivation.

Disbud vines and thin out shoots on young trees in the orchards.

The first of the new season's stone fruits will ripen this month in the warmer districts: "Edward VII.," "Bell's November," and similar varieties of peaches being fit for gathering before the 30th. These varieties, if not well grown, are very poor in quality and appearance, and winter pruning should have been done with the idea of restricting the trees' production by the removal of a large proportion of the fruiting wood; but no matter how carefully and well winter pruning is carried out, it will be found in a normal season that thinning the young fruits is essential if size and quality are to be obtained. This refers not only to the fruits above mentioned but to the major portion of the kinds of fruit now being grown, and I know of no single operation in the work on the orchard that is so generally neglected as thinning out young fruits, nor one that pays better when it is efficiently done. Fruit is sold by the pound or case in Western Australia, and just as many pounds or cases will be gathered from a tree that has been judiciously thinned as from one that has been allowed to over-crop: one fruit on the thinned tree equalling in size and weight two and sometimes even three on the tree that has over-cropped. But quite apart from the fact that the quantity harvested is nearly the same, the large sized, good quality fruit will always find a market and command a price where the small, hard fruit lacking in juice and appearance is difficult to dispose of at any price.

In thinning stone fruits—peaches, apricots, and plums—the operation should be delayed until the natural shedding has taken place. If it is done before, many fruits will be removed by hand that would have fallen naturally. The shedding mentioned will be finished with nearly all varieites early this month. No hard and fast rule can be laid down as to the number to take off; the usual advice with peaches and apricots is to space the fruits to about four inches between them, but the trees rarely fruit evenly enough to allow of this being made an absolute rule. However, they should be thinned so that room is allowed each fruit to develop to the full size for the variety without touching its neighbour, and when the fruit is borne on lateral, willowy growths as distinct from short stiff shoots, care must be taken not to allow more weight of fruit at the ends than the wood can carry.

Apples and pears grow in clusters, at times as many as five together, and according to variety these should be thinned to one or two in each cluster. In dealing with small varieties, such as "Yates," especially where fruiting spurs have been developed right throughout the tree, one apple in each cluster is enough to leave; with "Dunn's" this would result in the fruit being too large, and two in each cluster may be left, provided, of course, the clusters are not

too close together. Judgment must be exercised in thinning "Cleo.'s," sufficient always being left on the trees to prevent the fruit becoming oversized, for where this happens Bitter Pit is sure to follow. "Jonathan's" must not be thinned too heavily, or the fruit will grow large and sappy and its keeping qualities be spoiled.

For the grower who is a novice at thinning, and fears when he looks at the ground after he has been at work on a tree for some time that he has sacrificed too much of the crop, the best plan by far is to count the fruits he has left on one of the main limbs, and gauging the strength of the limb and vigour of the tree he will know by the number of fruits whether he has taken too many or too few, calculating what number of the variety in question is required to fill a case when they reach maturity. I may say here that the beginner nearly always errs on the side of leaving too many on the tree.

In thinning apples and pears which, as stated above, grow in clusters, care must be taken to remove the fruits and leave the stems attached to the spurs. If the stems are taken off with the fruits the whole cluster is weakened, and the remaining fruits are liable to fall at a later date. With practice it is comparatively easy to take hold of an apple and bend it upwards in such a way that the stem parts readily from the fruit, but this can be done only if thinning is being carried out when the fruits are still quite small, or are naturally long-stemmed varieties. If they are short-stemmed like, for instance, "Jonathan's" and the apples in the cluster are touching each other, it is nearly impossible to remove one with the fingers without endangering the safety of those left behind. A small pair of scissors with blunt points makes a useful tool; a lemon clips can also be used, or a sharp budding knife in skilful hands performs the work rapidly and well.

Fruit Fly requires unremitting attention this month on the lines advised for October, the only difference being that there are more kinds and varieties of fruit now requiring attention.

Pear Slug will put in an appearance early in November, pears, plums, quinces and cherries being the main kinds of trees affected. Spray with Arsenate of Lead 2½lbs. in 50 gallons of water, excepting in the case of cherries which are ripening. These must be left until after the fruit is gathered or the spray will disfigure them.

Sulphuring for Oidium on the vines should be continued wherever the fungus shows up.

Continue treating apple trees for Woolly Aphis.

DECEMBER.

Continue cultivation and necessary treatment of insect pests and fungus diesases mentioned in work for October and November.

Complete work of thinning apples and pears.

Marketing will be the principal work in the stone fruit orchards this month, and the better the fruit is graded and packed the better will be the prices obtained. Grade evenly and never mix small and large fruit in one case; never mix first and second class fruit in one case, and never send to market very inferior fruit, which depresses prices of good fruit, causes gluts, and robs the pigs which should be kept on the orchards of their just dues. It is very, very rare indeed that a glut of really good fruit occurs, but there is always a very limited market for rubbish.

POTATO STORAGE AND FUMIGATION EXPERIMENTS.

By L. J. Newman, F.E.S., Entomologist, and G. N. Lowe, Senior Potato Inspector.

The statement oft repeated by those dealing in the storage of locally-grown potatoes, that they do not keep well, is unfortunately in many instances only too true. It is not that the local tubers have not good keeping qualities, but it due in the main to the following causes. First and foremost is the ravages caused by the Potato Moth (*Phthorimaea operculella*) erroneously termed the "Potato Fly." The caterpillars arising from the eggs of this moth bore through the tubers in all directions, thus giving entrance to various destroying fungi and bacteria. This pest when placed under average storage conditions during the summer months, rapidly spreads throughout the whole of the consignment, and with the combined action of the fungi and bacteria, we have the spectacle of whole truck loads being condemned as unfit for human consumption.

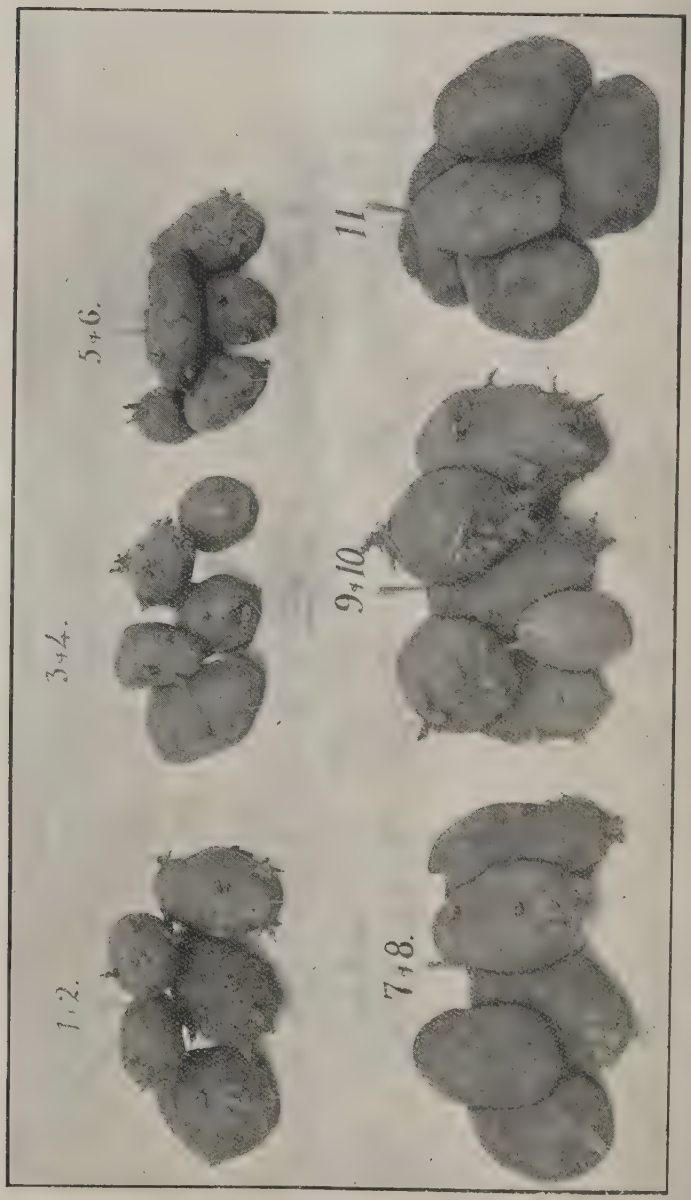
The second causative factor is a fungus (*Fusarium sp.*) which, when stored under ordinary summer shade conditions, temperature and humidity, also rapidly spreads from tuber to tuber, causing an added loss to that already damaged by the moth.

The third reason for the non-keeping qualities complained of, is apparent carelessness in digging, bagging, cartage, and selection of the tubers for storage. Tubers bruised with the digging tools and sunburnt tubers are bagged together with those affected with the before-mentioned diseases. Frequently bags, when being loaded are roughly handled, and the potatoes consequently badly bruised. Growers and others handling potatoes intended for protracted storage must recognise that to successfully store this produce, it is just as essential to eliminate diseased and damaged tubers as it is when storing apples or other produce. Unfortunately there is an idea prevailing that potatoes can be bruised and roughly handled without injuring their keeping qualities.

A visit to stores where potatoes are handled will reveal quantities of potatoes which have to be rejected, and is sufficient evidence to convince one why the grower and dealer in potatoes must exercise more care.

It is not sufficient to remove all infested tubers when storing. After this has been carefully done the tubers must be kept under moth free conditions, and to do this it is necessary to place them where the moth is excluded, otherwise it will not be long before the clean stored crop will become reinfested. To ensure that all forms of the moth, after picking out all obviously infested material, is destroyed, it is wise to fumigate twice at intervals of six to eight days with Carbon bi-sulphide (CS_2). Two fumigations are recommended, because of the presence of eggs, which are resistant to the gas. These eggs hatch in from six to eight days into caterpillars, and are thus destroyed by the second fumigation. Period of fumigation 48 hours. Quantity of chemical, 2lbs. per 1,000 cubic feet of space. (*Note.*—Being inflammable, all naked lights must be kept away.)

To test the keeping qualities of local potatoes under cool storage, ranging from a minimum of 33 deg. to maximum of 44 deg., with a general aver-


1, 2.
3, 4.
5, 6.
7, 8.
9, 10.
11.

age of 39 deg., three experiments were undertaken. Experiment 1.—(a) Swamp grown, freshly dug, moth and disease free potatoes, variety "Delaware"; (b) Potatoes from the South-West, dug six weeks prior to cool storage, moth and disease free, variety "Delaware." Experiment 2—Moth infested and affected with fungus (*Fusarium sp.*), previously stored three months at Robb's Jetty Stores, variety "Delaware." Experiment 3—Moth infested and affected with fungus (*Fusarium sp.*), previously stored three months at Robb's Jetty Stores, and fumigated with CS_2 gas before cool storage, variety "Delaware."

The potatoes in each experiment were stored in sacks two deep at the Government Cool Stores, Perth. The total quantity experimented upon was 40 bags. The period of the test was 120 days or four months.

Block 1.

POTATO STORAGE EXPERIMENTS.

1922.

All samples are "Delaware," drawn from a total of 40 bags cool stored at the Government Refrigerators.

Photographed 4 weeks after withdrawal.

EXPERIMENT 1.—(Moth and Disease free)—

Specimens 1 *and* 2—

Hill grown. Dug 42 days before cool storage.
Cool stored 1–2–22, removed 31–5–22 = 120 days.
Note sound condition and strong healthy shoots.
Cooking Test.—Good. *As Seed.*—Good.

Specimens 3 *and* 4—

Hill grown. New dug when placed in Robb's Jetty Store on 1–11–21.
Cool stored 1–2–22, removed 31–5–22 = 120 days.
Total period of storage = 7 months.
Cooking Test.—Medium. *As Seed.*—Good.

Specimens 7 *and* 8—

Swamp grown. New dug when cool stored on 1–2–22.
Withdrawn 31–5–22 = 120 days.
Note sound condition and sound healthy shoots.
Cooking Test.—Good. *As Seed.*—Good.

EXPERIMENT 2.—(Moth-infested Tubers. Unfumigated)—

Specimens 5 *and* 6—

Hill grown. New dug when placed in store at Robb's Jetty on 1–11–21, prior to cool storage.
Cool stored 1–2–22, withdrawn 31–5–22 = 120 days.
Total Storage = 7 months.
Cooking Test.—Medium. *As Seed.*—Only fair owing to ravages of Moth prior to cool storage. *Sprouting*, however, is good.

EXPERIMENT 3.—(Moth-infested tubers. Fumigated with gas CS_2 prior to cool storage)—

Specimens 9 *and* 10—

Hill grown. New dug when placed in store at Robb's Jetty on 1–11–21, prior to cool storage.
Cool stored 1–2–22, removed 31–5–22 = 120 days.
Total storage = 7 months.
Cooking Test.—Poor, soapy, and sweetish flavour. *As Seed.*—Somewhat shrivelled, but otherwise good.

Specimen 11—

Tubers as they appeared when withdrawn after 120 days cool storage.
Note sound condition.

Cooking and edible tests and examinations of the moth-infested tubers were made at intervals of 37, 72, 94, and 120 days, also weekly examinations were made by an officer. The daily temperatures were taken both morning and afternoon.

During the period of the test there were several factors which caused some slight irregularities in the temperature. When the test first started in February the works, on account of the hot weather, were working a continuous shift, and thus a general colder average was maintained. Later, as the weather cooled off, the need for the continuous working of the plant was unnecessary, and consequently a single day shift was instituted. This had the effect of slightly raising the average temperature. About half-way through the experiment the dry air system replaced the pipe and brine system, and this had the effect of slightly lowering the general average temperature again.

The tubers used in Experiment No. 1 were carefully selected, all damaged moth and fungus infested being as far as possible eliminated. (See illustration No. 11, Plate I.)

The selection of only good sound clean potatoes was made because it was realised that the damaged or diseased tubers could not be expected to give a satisfactory answer to the question of the keeping qualities of local potatoes under cool storage conditions.

In the case of the swamp-grown potatoes they were dug, bagged, and stored within one week. The potatoes selected from the South-West had been dug some six weeks before storing in cool storage. In both cases the variety of tubers was the same, namely, "Delaware."

The period of the test was 120 days, or four months. Commenced 1st February, 1922; terminated 31st May, 1922.

To summarise the results of the test, they are as follow:—

Cooking, Edible, and Keeping Tests, made 37 days after cool storage, revealed no signs of serious deterioration, the tubers being firm and crisp, cooked well, flavour good, and no evidence of shooting or decay.

POTATO COOL STORAGE—EXPERIMENT I.

COOKING, EDIBLE, AND KEEPING TESTS.

Commenced, 1–2–22. Terminated, 9–3–22. Period 37 days.

Sixteen tubers selected from each lot for sample test.

No.	Period.	Temperature.	No. Tubers.	Cooking Test.	Remarks.
	days.				
1	37	39°	16	Excellent ...	Clean, sound, flavour good, dug 42 days.
2	37	39°	16	do. ...	Clean, sound, flavour good, dug 42 days.
3	37	39°	16	Good ...	Clean, sound. Had been stored Robb's Jetty Stores prior to being placed in Government Cool Stores, hence the slight difference in cooking qualities, as compared withthose freshly dug, and those from South-West dug 42 days, and placed in Government Cool Store.
4	37	39°	16	do.	
7	37	39°	16	Excellent ...	Flavour good, clean and sound, freshly dug.
8	37	39°	16	do. ...	Flavour good, clean and sound, freshly dug.

Note.—Up to this period at above temperature no damage done to cooking or edible qualities.

After further 35 days, making a total of 72 days from the inception of the experiment, cooking, edible, and keeping tests proved that, up to this point, no serious deterioration had set in, excepting in the case of the tubers previously stored three months at Robb's Jetty prior to cool storing. These proved soapy in texture and of a sweetish flavour.

POTATO COOL STORAGE—EXPERIMENT I.

COOKING, EDIBLE, AND KEEPING TESTS.

Sixteen tubers selected from each lot for sample test.

Commenced, 1-2-22. Terminated, 13-4-22. Period, 72 days.

No.	Period.	Temperature.	No. Tubers.	Cooking Test.	Remarks.
	days.				
1	72	39°	16	Good	Kept firm. No shooting noted. Flavour good. Dug 42 days before cool storage.
2	72	39°	16	do. ...	Kept firm. No shooting noted. Flavour good. Dug 42 days before cool storage.
3	72	39°	16	Fair ...	These tubers had been stored 3 months at Stores, Robb's Jetty, prior to placing in Perth Cool Stores, and as in first test, continued to show more rapid deterioration than the freshly dug tubers and those dug 42 days.
4	72	39°	16	do.	
7	72	39°	16	Good	Firm. No shooting. Flavour good.
8	72	39°	16	do. ...	Firm. No shooting. Flavour good.

NOTE.—After a period of 72 days at the above temperature, the freshly dug tubers and those dug 42 days had not appreciably deteriorated. The tubers from Robb's Jetty, however, had somewhat deteriorated which was to be expected, as the temperature at Robb's Jetty Stores had several times reached 85° to 90°.

The next critical test was made after the expiry of a further 22 days, making a total of 94 days cool storage.

With the exception of Lots 3 and 4, which had further deteriorated, the tubers still gave good cooking and edible tests, although a slight sweetish flavour was noted, and in one or two instances a slight mustiness was apparent. No movement of buds was noticed. It was found, however, that the sweetish flavour was of slight significance, as the same tubers, kept for a week or 10 days after removal from cool storage, became normal in flavour.

POTATO COOL STORAGE—EXPERIMENT I.

COOKING, EDIBLE, AND KEEPING TESTS.

Sixteen tubers selected from each lot for sample test.

Commenced, 1–2–22. Terminated, 8–5–22. Period, *94* days.

No.	Period.	Temperature.	No. Tubers.	Cooking Test.	Remarks.
	days.				
1	94	39°	16	Good	A little inferior to when tested on 13–4–22. Inclined to be sweet in flavour. No shooting noted. Dug 42 days before cool storing.
2	94	39°	16	do. ...	A little inferior to when tested on 13–4–22. Inclined to be sweet in flavour. No shooting noted. Dug 42 days before cool storing.
3	94	39°	16	Fair ...	These tubers stored 3 months at Robb's Jetty Store prior to placing in Cool Stores, Perth, hence their great depreciation Slightly soapy and dark after cooking.
4	94	39°	16	do.	
7	94	39°	16	Good	Slight deterioration compared to previous test. No shooting noted. Flavour musty. Freshly dug.
8	94	39°	16	Excellent ...	Very flowery. No appreciable deterioration. No shooting noted. Flavour good. Freshly dug.

The final tests made were on the termination of the experiment, a period of 120 days or four months in cool storage.

Lots 1, 2, 7, and 8 were still sound and firm, cooking and edible qualities good, sweetish flavour still noticeable, but not increasingly. No sign of shooting, in fact the tubers were in very fine condition considering they had been cool stored for a period of four months. See illustration No. 11, Plate I.

Lots 3 and 4 had reached the limit of their storage, being shrivelled, soapy in texture, and turned black when cooked.

POTATO COOL STORAGE—EXPERIMENT 1.

COOKING, EDIBLE, AND KEEPING TESTS.

Sixteen tubers selected from each lot for sample test.

Commenced, 1-2-22. Terminated, 31-5-22. Period, *120* days (4 months).

No.	Period.	Temperature.	No. Tubers.	Cooking Test.	Remarks.
	days.				
1	120	39°	16	Good	Clean, sound, flavour good. Dug 42 days before cool storage.
2	120	39°	16	do. ...	Clean, sound, flavour slightly sweetish. Dug 42 days before cool storage.
3	120	39°	16	Medium ...	Have about reached the limit of their storage, shrivelled, buds developing, flavour poor. Soapy in texture, turned dark after cooking. Have been stored a total of 7 months, 3 months at Robb's Jetty before being placed in cool-storage.
4	120	39°	16	Medium ...	Same as No. 3.
7	120	39°	16	Good	Flavour good, slight deterioration, no shooting, slight musty flavour, swamp grown, freshly dug.
8	120	39°	16	Good	Flavour good, conditions of tubers firm, no sign of shooting, freshly dug, swamp grown, excellent seed.

To prove the good condition of these tubers it is only necessary to quote the price they brought—£10 per ton as seed, which was most satisfactory.

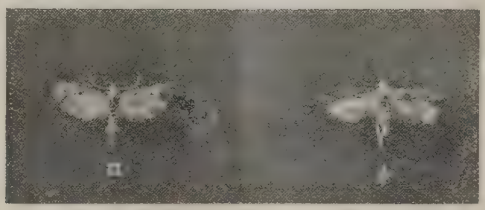
From a seed-keeping point of view there appears to be a great use in cool storage.

The tubers, after removal from cool storage, made vigorous shoots. See illustrations Nos. 1, 2, 3, 4, 7, and 8, Plate I.

There is one point that was noticed during the experiment, namely, the effect of bringing cool stored tubers out into a hot building or store. The potatoes when suddenly transferred from an average temperature of 39 degrees or less to 85 degrees to 95 degrees, sweat and become very moist, and would certainly have a tendency to saturate the bags, and by that means set up decay in the stack. It may be necessary when removing potatoes from

cool store during hot weather to pre-warm them. When the outside temperature is about 60 deg. to 70 deg., this sweating does not take place to any dangerous extent.

In conclusion we have every reason to believe that local tubers, after careful selection and handling, can be successfully cool stored at tempera-



Imago or adult Potato Moth. *a* Male. *b* Female.

tures ranging from 39 deg. to 45 deg. Included in Test No. 1 were tubers which had previously been stored three months at Robb's Jetty Stores under

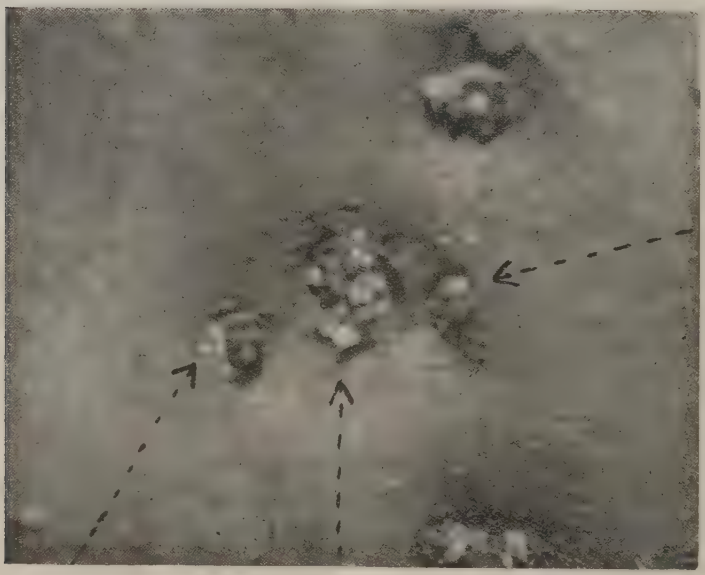


Plate III.—Eggs of moth in eyes of tuber (enlarged).

average summer shade temperatures before being selected for cool storage. These tubers naturally, in comparison to the fresher potatoes, did not go through the four months' cool storage as successfully, but nevertheless, although handicapped, yielded fair results up to 94 days. After this period they shrivelled, were soapy in texture, and turned black after cooking.

As a test case of keeping qualities, Experiment I., Nos. 3 and 4, were of little use. They served, however, to demonstrate that even after the three

months' storage under ordinary summer shade conditions, the keeping qualities were extended for a further three months in fair condition, and were still useful for seed, and suggest that had the Robb's Jetty Stores been in readiness to reduce the temperature of their chambers to the region of 40 deg. F., the loss which attended the storage of tubers therein would have been prevented, as the ravages of the potato moth and the *Fusarium* fungus would not have occurred.

Experiment No. 2—Cool Storage effects on the life stages of the Potato Moth (Phthorimaea operculella) and the Fungus (Fusarium sp.).—The object of this experiment, which was run in conjunction and under the same

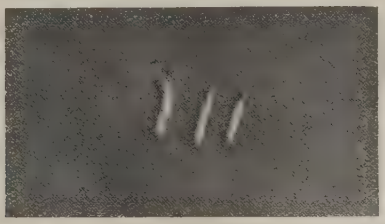


Plate IV.—Potato Moth larvæ.

conditions as the first, was to ascertain what destroying or checking effect the application of cold would have on these two destructive agents.

The first critical examination was made 37 days after placing in cool storage at 39 deg. It was then found that although living larvae and pupae were present the caterpillars had become torpid, and had ceased feeding. No

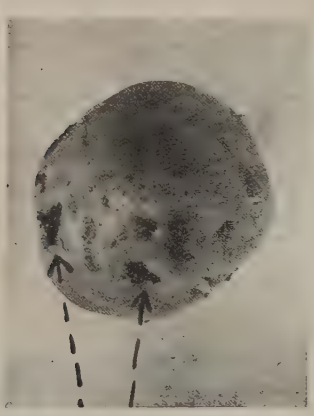


Plate V.—Infested tuber, showing castings at entrance to larval tunnels.

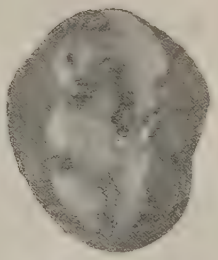


Plate Va.—Infested tuber cut, showing internal damage by larvæ.

moths had issued and no eggs hatched. It was thus demonstrated that the placing of infested tubers in cool storage at the above temperature inhibited the work of the potato moth larvae and the work of decay organisms. The *Fusarium* fungus was also checked.

EXPERIMENT II.

COOL STORAGE EFFECT ON THE LIFE STAGES OF THE POTATO MOTH.

Sixteen tubers selected from each lot for sample test.

Commenced, 1–2–22. Terminated, 9–3–22. Period, 37 days.

No.	Period.	Temperature.	No. Tubers.	Effect on Moth Stages.	Remarks.
	days.				
5	37	39°	16	Two living and 8 dead larvae, and 1 living pupa. No eggs.	The effect of the cool storage is apparently to drive the larvae out of the tubers and at once arrests the development of other stages. It will be noted that the period (37 days) at this temperature has not completely killed all the larvae, 25 per cent. being still alive, although inactive, and one living pupa. No eggs were discovered. No cooking tests made, as tubers, owing to moth infestation were rendered unfit for eating. Had been stored for three months, Robb's Jetty prior to cool storage.
6	37	39°	16	One larva living and 4 dead. No pupae or eggs found.	Same. With the exception that no pupae were found.

A further examination was made 35 days later, a total period of 72 days storage. It was then found that all living forms of the potato moth had ceased to exist, sometime between 37 days and 72 days, probably about 60 days, as was demonstrated in the lesser experiment previously carried out.

The *Fusarium* fungus had also ceased to spread, thus proving that this disease can be controlled by cool storage.

EXPERIMENT II.

EFFECT OF COOL STORAGE ON THE LIFE STAGES OF THE POTATO MOTH.

Sixteen tubers selected from each lot for sample test.

Commenced 1–2–22. Terminated, 13–4–22. Period, 72 days.

No.	Period.	Temperature.	No. Tubers.	Effect on Moth Stages.	Remarks.
	days.				
5	72	39°	16	No living life forms found	Storage for this period at temperatures of 39° evidently destroys all life forms of moth. The only larvae found were dead and decayed. Tubers were much burrowed by moth larvae. Had been stored 3 months at Robb's Jetty prior to being placed in Cool Stores, Perth.
6	72	39°	16	Two dead larvae found	

A feature of the effect of the application of cold is to cause the larvae to leave the tubers. Although heavily infested when placed in cool storage, after 60 days it is difficult to find any trace of same either in the tubers or bags.

Further examination of these tubers were made after periods of 94 to 120 days, but, as was to be expected, no living forms of the Potato Moth were found. The *Fusarium* fungus was well controlled. This experiment has demonstrated without doubt that the *Fusarium* fungus is at least rendered inoperative during the cool storage, and in the case of the moth all stages were totally destroyed. (See illustrations 5 and 6, Plate I.)

EXPERIMENT II.

Effect of Cool Storage on the Life Stages of the Potato Moth.

Sixteen tubers selected from each lot for sample test.

No.	Period.	Temperature.	No. Tubers.	Effect on Moth Stages.	Remarks.
	days.				
5	94	39	16	No living larvae or other forms found.	It was not expected that any Moth development would be found, as all stages were dead when the last test was made 13–4–22. These tubers stored 3 months prior to placing in Cool Stores, Perth.
6	94	39	16	do. ...	

EXPERIMENT II.

Effect of Cool Storage on the Life Stages of the Potato Moth.

Sixteen tubers selected from each lot for sample test.

Commenced, 1–2–22. Terminated, 31–5–22. Period 4 months.

No.	Period.	Temperature.	No. Tubers.	Effect on Moth Stages.	Remarks.
	days.				
5	120	39°	16	No living forms of moth found in previous two examinations so there was no necessity for further examination.	Total storage seven months—3 months at Robb's Jetty Stores prior to cool storage.
6	120	39°	16		

Experiment No. 3.—Potato Moth and *Fusarium* infested tubers fumigated with CS_2 gas (Carbon bi-sulphide) at the rate of 2lbs. per thousand cubic feet of space for 48 hours prior to being placed in cool storage. A portion of this fumigated material was placed under ordinary shed storage. An examination after three weeks' fumigation revealed almost an entire

absence of any living forms of the Potato Moth, although heavily infested when placed in fumigation chamber. There is no question as to the effectiveness of this gas as a killing agent of the Potato Moth larvae. The keeping qualities of these tubers, however, after the fumigation, was short, but not

Unfumigated potatoes after three months' ordinary storage. *Note* effect of moth invasion.

Fumigated tubers from same bag as those shown in Plate 6. *Note* moth free condition or strong healthy shoots after three months' storage.

as a result of fumigation, fungus and bacteria quickly causing them to rot. They had been stored three months at Robb's Jetty Stores prior to fumigation. The balance of the fumigated tubers were placed in the cool store under similar conditions to the two preceding experiments. After a period of 37 days an examination was made; no living forms of the Potato Moth being found, although dead and decayed larvae and pupae were noted.

At this period the infested cool stored, *unfumigated* tubers revealed on examination the presence of living forms of the Potato Moth. This proves the effectiveness of the gas treatment on the larvae of the moth before they were cool stored. There is, however, no necessity or advantage in so treating moth-infested tubers before cool storing. It has been well demonstrated that the application of cold is of itself an effective method of nullifying the destructive powers and ultimately destroying all stages of the moth.

Further examinations were made at intervals of 72, 94, and 120 days. No evidence of moth was found, and the ravages of the *Fusarium* fungus controlled. (See illustration Nos. 9 and 10, Plate I.)

EXPERIMENT III.

MOTH INFESTED TUBERS, FUMIGATED WITH CS_2 AND COOL STORED.

Sixteen tubers selected from each lot for sample test.

Commenced, 1–2–22. Terminated, 9–3–22. Period, *37* days.

No.	Period.	Temperature.	No. Tubers.	Effect on Moth Stages.	Remarks.
	days.				
9	37	39°	16	No living larvae or pupae found	Gas and cold combined had evidently driven all larvae out of tubers; tubers kept well in store: were not fit for cooking owing to ravages of moth prior to fumigation and cool storage.
10	37	39°	16	Four dead and decayed larvae found, also two pupae; no living forms.	Conditions same as in No. 9, with the exception of finding the four dead larvae and two dead pupae. Differed from previous test when no gas was used prior to cool storage in that all forms of moth were dead, at 37 days storage.

EXPERIMENT III.

MOTH INFESTED TUBERS FUMIGATED WITH CS_2, AND COOL STORED.

Sixteen tubers selected from each lot for sample test.

Commenced, 1-2-22. Terminated, 13/4/22. Period, *72* days.

No.	Period.	Temperature.	No. Tubers.	Effect on Moth Stages.	Remarks.
	days.				
9	72	39°	16	No living forms found	Very much bored by moth larvae. Had been in storage at Robb's Jetty 3 months prior to being fumigated and placed in Cool Store.
10	72	39°	16	do. ...	Very much bored by moth larvae. Had been in storage at Robb's Jetty 3 months prior to being fumigated and placed in Cool Store. Otherwise in medium condition.

EXPERIMENT III.

MOTH INFESTED TUBERS FUMIGATED CS_2, AND COOL STORED.

Sixteen tubers selected from each lot for sample test.

Commenced, 1-2-22. Terminated, 8-5-22. Period, *94* days.

No.	Period.	Temperature.	No. Tubers.	Effect on Moth Stages.	Remarks.
	days.				In comparison with the tubers fumigated and stored under ordinary shed accommodation these have kept well, those of the same consignment not cool stored going rotten in three weeks. It was not expected that tubers which had been stored for three months at Robb's Jetty Stores and badly invaded by the Moth larvae would keep as well as those freshly dug and Moth free.
9	94	39°	16	No living forms found.	
10	94	39°	16	do.	

EXPERIMENT III.

MOTH INFESTED TUBERS FUMIGATED CS_2, AND COOL STORED.

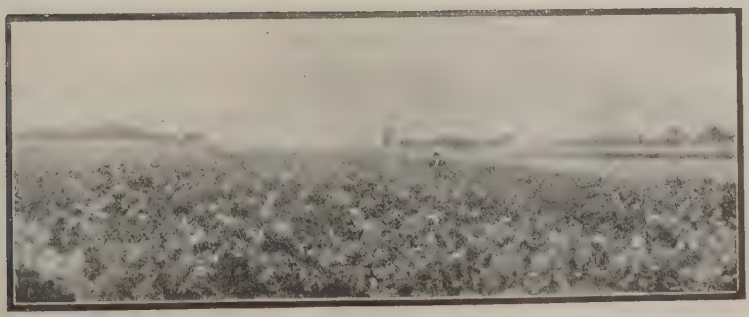
Sixteen tubers selected from each lot for sample test.

Commenced, 1-2-22. Terminated, 31-4-22 = *120* days.

No.	Period.	Temperature.	No. Tubers.	Effect on Moth Stages	Remarks.
	days.				
9	120	39°	16	No living forms of moth found	Total storage, seven months—3 months at Robb's Jetty Stores before cool storage.
10	120	39°	16	do. ...	

The controlling effect of cold storage on the *Fusarium* and other destroying bacteria was well illustrated by the rapid way in which the non-cooled stored portion of the fumigated tubers rapidly developed Fusarium and other decay-producing organisms, whilst the portion of cool-stored kept in fair condition for a further 94 days or three months.

We claim, finally, as a result of our investigations, that the storage of local tubers presents no difficulties, provided growers and others interested are prepared to carry out the necessary conditions. These conditions include careful digging, bagging, selection of disease-free produce, careful carriage, and the provision for fumigation or suitable cool storage accommodation at rates which will repay both the producer, merchant, and consumer.



PRODUCE PRICES.

The following information regarding certain kinds of produce during the months of June, July, and August, 1924, has been supplied by Messrs. H. J. Wigmore & Company, Limited, of Wellington Street, Perth, and will be valuable for reference:—

——	June.	July.	August.
CHAFF—			
F.A.Q. to Prime Wheaten ...	£7 15s. per ton	£8 10s. per ton	£8 5s. per ton.
WHEAT—			
F.A.Q.	4s. 9d. per bush.	5s. 7d. per bush.	5s. 11d. per bush.
OATS—			
Algerian and Lachlans ...	3s. 7d. per bush.	3s. 10d. per bush.	3s. 11d. per bush.

Chaff.—Prices during the past three months have been very satisfactory from a producer's point of view, and were fully 75 per cent. better than the rates ruling at the beginning of the year. The low prices ruling at haymaking time evidently decided farmers, where possible, to strip instead of putting the binder in with the result that there was not a great deal of hay cut, and most farmers holding stocks did not feel inclined to dispose of their surplus until such time as they were pretty well assured of a crop in the coming season, and with the season opening so dry consignments to this market gradually dwindled and prices firmed. The market was at its zenith at the end of July and the beginning of August, the top price for a few days being £9 7s. 6d. However, immediately farmers saw another good season in sight they naturally were inclined to dispose of all they could possibly spare, with the result that for a few weeks the market was glutted and prices sagged down to £7. However, during the last week or two supplies have to some extent fallen off, and at the time of writing real prime chaff is worth £7 10s. to £7 15s. per ton.

Oaten Chaff.—The same remarks apply to this as to wheaten, with the exception that generally speaking the value of f.a.q. oaten was about 15s. per ton lower than that for top price wheaten.

Oats.—This market was also affected by the weather, and at the end of July and early August good heavy feed Algerians were sold up to 4s. 2d. per bushel. At time of writing the market is rather dull at around 3s. 10d. per bushel.

Wheat.—Overseas' quotations practically rule this market. It will be seen that prices have been very satisfactory, and f.a.q. has been sold under the hammer up to 6s. 2½d. per bushel, but the market is now hovering around 5s. 10d. per bushel.

Forecast.—It is a very difficult matter to even try to forecast such a market as this, but there is every likelihood of the market remaining steady until the new season's cut begins to find its way to market, when under the weight of supplies coming to hand prices will naturally ease.

LIVE STOCK AND MEAT.

For the information of readers of the *Journal*, the following particulars have been supplied by Messrs. Elder, Smith, & Company, Limited, Perth:—

COMPARATIVE YARDINGS OF STOCK AT METROPOLITAN FAT STOCK MARKETS, DURING MONTHS OF JUNE, JULY, AND AUGUST.

	JUNE.				JULY.					AUGUST.			
	4.	11.	18.	25.	2.	9.	16.	23.	30.	7.	13.	20.	27.
Sheep and Lambs	6,348	3,908	5,355	5,636	6,307	5,468	5,868	7,157	6,981	6,562	6,310	6,512	10,904
Cattle ...	781	686	775	947	1,157	802	837	774	894	1,025	634	1,013	1,021
Pigs ...	600	370	707	595	536	606	451	872	692	655	942	993	695

COMPARATIVE VALUES OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS DURING MONTHS OF JUNE, JULY, AND AUGUST.

	JUNE.				JULY.					AUGUST.			
	4.	11.	18.	25.	2.	9.	16.	23.	30.	7.	13.	20.	27.
Mutton ...	12½	14	14	14	14	14½	13¾	14	13	12¼	12¾	12¾	13
Beef ...	6½	7¼	8½	7¼	6½	6¾	7	8½	8½	8¾	9½	7½	8½
Pork ...	12	12½	13	13	13	13	13½	12¼	12	12	11½	10½	10½
Bacon ...	10	10¼	10½	10½	10	10¼	10½	10¾	11	11	10¾	10½	10½

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No. 20.—"The Pruning of Fruit Trees." By J. F. Moody. Price 2s. 6d.
No. 46.—"Fruit Packing and Marketing and Exporting of Fruit." By J. F. Moody and J. Ramage. Price 1s. 6d.
No. 47.—"The Poultry Keeper's Manual." By G. Allman. Price 1s.
No. 83.—"Horticulture and Viticulture." By A. Despeissis. Price 2s.
No. 5.—"Fruit Drying." By J. F. Moody. Free.
No. 15.—"Root Rot." By A. J. Despeissis. Free.
No. 24.—"Hints to Stock Breeders" (revised). By R. E. Weir. Free.
No. 41.—"Irrigation and Drainage." By A. H. Scott. Free.
No. 49.—"The Feeding of Horses." By Professor Paterson and G. L. Sutton. Free.
No. 57.—"Vermin Destruction." By A. Crawford. Free.
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No. 118.—"Pigs and Pig Raising." P. G. Hampshire.
No. 119.—"Take-all of Wheat and Similar Diseases of Cereals." By W. M. Carne and J. G. C. Campbell.
No. 120.—"Pastures in the South-West." A. B. Adams. (Reprint from "Journal.")
No. 121.—"Mildew, Septoria, Leaf Spots, and Similar Diseases of Cereals." W. M. Carne and J. G. C. Campbell.
No. 122.—"Fruit-fly. Description and Control." L. J. Newman.
No. 123.—"The Development of a Dairy Herd." P. G. Hampshire. (Reprint from "Journal.")
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No. 125.—"Buy Good Seed." (Advice to Farmers.) W. M. Carne. (Reprint from "Journal.")
No. 126.—"The Rust of Cereals." W. M. Carne and J. G. C. Campbell.

No. 127.—Wheat Yields—Competitions.
No. 128.—"Woolly Aphis Parasite (*Aphelinus mali*)." (Hald.) L. J. Newman. (Reprint from "Journal.")
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This publication contains valuable information dealing with all commercial fruits grown in Western Australia, including advice on planting, pruning, packing, manuring, fruit-drying, wine-making, insect and fungoid pests and their treatment, etc., and the whole forms a text book which every fruitgrower, whether large or small, should have in his possession. The price originally was 8s. 6d., but to allow of distribution being as wide as possible, it has been reduced to 2s.

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This publication contains invaluable information on packing and grading fruit for local and export markets. It is freely illustrated, and no fruit-packing shed should be without a copy. Price, 1s. 6d.

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This is a most useful and valuable book, not only for beginners, but to all those who keep fowls for pleasure or profit. It deals fully with all matters connected with the industry, including Breeding, Feeding (for stock birds or egg production), Incubating, Brooding and care of chicks, Marketing (eggs and poultry), and all matters of use to the poultry-keeper. It also fully describes symptoms of various ailments and diseases and simple treatment for same, and, as the book was written to suit *Local Conditions*, every poultry-keeper should have a copy by him. Price, 1s.

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